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Panama Canal Rumors.

Dame Rumor after a well earned vacation has returned to her job on the Panama Canal and the stimulating effect of her presence is already being shown by the increased output of press dispatches. The worthy lady has lost none of her old fire and enthusiasm. Her first move has been an attack all along the line with reports of the resignations of Chief Engineer Goethals, Commissioner of Labor Smith and General Manager Bird of the Panama R. R. Secretary Taft has wheeled himself into line and met the attack with a rapid fire of denials. "A tissue of falsehoods" is the characterization which the honorable Secretary applies to these reports. Meanwhile Mr. Ripley has resigned "because he and Major Goethals did not agree as to the character of some works under way," and General Purchasing Officer Ross, "because of his private business." Major Goethals is criticised because 150,000 cu. yds. less of material was removed from the Culebra cut in a recent month than was removed the preceding month by his predecessor in office. The major is also accused of being behind the recent executive order closing the Panama Canal offices at Washington and putting it up to Secretary Joseph Bucklin Bishop and "more than 100 clerks and other employes" to go to Panama or to step down and out. Last act of all seven expert accountants are examining the canal work accounts "on suspicion that gigantic frauds have been committed." Altogether things are moving right along. Indeed, the only regret that is voiced is that "nothing has been heard from President Roosevelt." Perhaps he is reflecting on that message in his favorite *Spectator* where Dick Steele remarks that: "Rumour is too short-lived to stand up in competition with glory, which is everlasting."

Tunnel Work at New York.

The great amount of tunnel work now going on in the vicinity of New York city is known in a general way to most of our readers. To keep the separate projects clearly in mind and particularly to preserve a clear mental picture of the methods of construction adopted in each case is, however, a task of some difficulty with only the recollection of scattered articles read at odd times to aid one. It is for this reason that we give considerable space in this and the next issue to an article summarizing the several separate pieces of tunnel work now in progress under Manhattan Island and the Hudson and East rivers and in contiguous territory. Naturally the space that can be given to each piece of work in an article of this character must be brief and such, the reader will find, is the case. Withal the article covers some ten pages, which goes to show the immense amount of work in progress. It will be noted furthermore that no mention is made of the projected tunnel work for rapid transit railway development. This projected work will within a few years comprise two or more double track lines under the East River and one under the harbor to Staten Island. Even with these projected works in mind it would be a bold spirit who would say that it saw the end of tunnel work in and around the great eastern metropolis. It is safe to say that at no time in the history of the world has there been so much tunnel work concentrated in so small a territory as is now in progress in New York city. No such difficult tasks of soft ground tunneling have ever been carried on elsewhere in the world. In expenditure of money the tunnels listed in the paper which we reprint almost equal the cost of the Panama Canal. It is moreover work which is being financed entirely by private capital while the construction is being done entirely by private contract. No better evidence is needed of the ability of American contractors to build the Panama Canal than is furnished by the success with which these contractors are prosecuting the difficult and costly work of the New York city tunnels.

William Finlay Shunk.

Railway engineers owe a large debt to William Findlay Shunk. Mr. Shunk was not only an active and brilliant worker in his adopted field of engineering but through his books on railway field work he did much to smooth the path of those who followed him in the service. Shunk's "A Practical Treatise on Railway Curves and Location for Young Engineers" was one of the first books for railway locating engineers and to it and his later and more comprehensive pocket book on "Field Engineering" many a railway engineer now living owes his earliest recollection of a railway engineering field manual. Mr. Shunk's chief pride as a writer was in the fact that he wrote for young engineers. Having been himself compelled to pick up his knowledge of railway engineering by hard knocks and with no special training he knew well the trials and mischances that the young man courted when he took up the practice of railway engineering in the days of few books and fewer engineering schools. He resolved to make the work of these young men easier in so far as lay within his power and it was in pursuance of this resolution that he wrote his books in simple and plain language suitable for the beginner. Perhaps no greater monument could be reared to Mr. Shunk now that he is dead than the memory that railway engineers keep with them of the aid furnished them at their start in the profession by "Shunk's book." Mr. Shunk died at his home at Harrisburg, Pa., on June 22 in the 77th year of his age. He entered the services of the Pennsylvania R. R. in 1850 and, with the exception of a few years during the Civil War, was engaged almost wholly in railway engineering work throughout his long professional career. For nearly 15 years he was active in elevated railway construction in New York city, being Chief Engineer of the Metropolitan Elevated R. R. from 1868 to 1874, of the Manhattan Elevated R. R. from 1876 to 1882, and of the Kings County Elevated R. R. from 1887 to 1889. In recent years Mr. Shunk's railway work had been mostly in South America. He was the engineer in charge of a portion of the survey for the much talked of Pan-American railway, and his portion of the report which was published on this survey will be remembered by those who read it for its shrewd obser-

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vations and happy comment on the manners and customs of the people encountered and on the commercial possibilities of the country passed through, as well as for its concise account of the engineering work done.

Announcement of the Consolidation of Engineering-Contracting and Engineering World.

Some business enterprises grow by consolidation, others by accretion, and a few by both. "Engineering-Contracting" belongs to the last named class. We are now able to announce the purchase of Engineering World which has been consolidated with Engineering-Contracting. This purchase is the third of its kind in the last eighteen months. On the first of January 1906, the "Roadmaster and Foreman," of Chicago, was bought and its name was changed to "Engineering-Contracting and Roadmaster and Foreman." Four months later "Contract News," of New York, was bought and consolidated with "Engineering-Contracting." Contract News was a weekly periodical thirteen years old. but it had never attained more than a comparatively local circulation in the eastern states, because it published little else than contract news. Nevertheless the readers that it did have were of an excellent class and made a material addition to the subscription list of "Engineering-Contracting."

The third purchase is the one announced in this issue. By the purchase, "Engineering-Contracting" adds several thousand subscribers to its list, and becomes the only weekly paper of its kind published outside of New York City. In New York are published two well known contemporaries, "Engineering News" and "Engineering Record." Aside from them, "Engineering-Contracting" has no competitors now; and, in a broad sense, the two New York papers are not competitors.

"Engineering-Contracting" occupies a field by itself, not only in the teritory that it covers but in the character of its reading matter. While any weekly engineering paper covers the whole United States, there is always a more or less local tone to its articles and its news—particularly to such of its news as is fresh. With an editorial staff confined to New York City, it is but natural that the works visited by members of the staff lie mostly in and about New York. Contributed articles and matter secured by correspondence tend to offset provincialism, it is true, but never entirely overcome it. It was this knowledge that led the management of "Engineering-Contracting" to locate in Chicago, the center of population of America, and to maintain an editorial staff in New York as well. That the move was a wise one is attested by the recent remarkable growth of the paper, both in subscriptions and in advertising patronage.

By virtue of our location, all contractors in the great Mississippi Valley and westward, receive their news of "bids asked" fully 48 hours in advance of those who rely upon news that must go to New York to be published, for the news items in engineering periodicals are mostly transmitted by mail. It takes 24 hours for the mails to travel from the center of population of the United States to New York, and an equal time to return. Hence the great advantage possessed by a weekly paper located at the center of population. "Engineering-Contracting" not only possesses this advantage, but it is the only weekly paper of its kind in America which reaches contractors on the Pacific Coast the same week of its publication. Published on Wednesday, it comes to its Pacific Coast readers on or before Saturday. This feature is one that has now many favorable comments from Western contractors, and accounts largely for the growing popularity of "Engineering-Contracting" as a contract news medium.

However, this is but one of several features which have contributed to our growth. The articles in this journal have, from the start, been edited with a view to eliminating all redundancy and "padding." We have aimed to produce a periodical worth preserving—not a mere weekly newspaper. Realizing that both the civil engineer and the contractor are vitally concerned in matters of costs, we have endeavored to make each volume of "Engineering-Contracting" a veritable reference handbook of information and a worthy sequel to the "Handbook of Cost Data" written by our managing editor. How well we have succeeded can best be seen by reference to the index of our last three semi-annual volumes. We may also add that rarely do we receive a subscription that is not accompanied by a request for all previous issues of "Engineering-Contracting" back to the first of the current volume. This indicates that our readers, new as well as old, regard the paper as possessing more than ephemeral value.

While we have made a specialty of articles on "methods and costs," and shall continue doing so, it is our plan greatly to enlarge the scope of our reading matter. This enlargement will not be made all at once, but as rapidly as our increased advertising patronage will enable us to expend more money in securing and printing more reading matter. With the acquisition of Engineering World we have secured additional contract news service which will become apparent in our succeeding issues. We have also effected an enlargement of our editorial staff, announcement of which will be made later.

The offices of Mr. Gillette, our managing editor, will remain in New York City. Mr. Gillette has just completed his work of securing the original cost and appraising the present value of all the railways in the State of Washington, aggregating a present value of nearly a quarter of a billion of dollars. While this work has kept Mr. Gillette in the West nearly a year, it has enabled him to secure a large fund of cost data from which the readers of Engineering-Contracting will benefit.

We enter upon the last half of our second year (the record under the present management) with a greatly increased circle of readers. To every one we wish a prosperity akin to that which has come to "Engineering-Contracting." Our interests, after all, are identical; and, in fact, we wish to be regarded by our readers not as an impersonal publication but as an aggregate of personalities interested, and vitally interested, in all that contributes to the commercial success of the contractor and the engineer. Indeed, our editorial policy of making public the itemized costs of construction is founded on a firm belief that it will be instrumental in eliminating the guesswork which has characterized both contracting and engineering in the past.

Possessed of an accurate knowledge of costs, the engineer becomes a more prominent factor in shaping the success of industrial enterprises, and, with an increased success as an industrial economist, will come increased compensation.

Possessed of comparative cost data, the contractor will not only bid more intelligently, but, after he has secured a contract, will know when his work is being economically executed and when not. In the future, as in the past, we stand willing and anxious to help our readers, and we trust that none will hesitate to write us for information, or to call upon us in a social way either at our Chicago or at our New York office.

To the readers of "Engineering World" we extend a hearty welcome. We believe that they, as well as the original readers of "Engineering-Contracting" will greatly gain by this consolidation.

The planting of trees on the watersheds at the headwaters of Allegheny and Monongahala River is advocated by the Pittsburg Chamber of Commerce, as a means of relieving Western Pennsylvania of the annual inundations from those rivers. During the last session of Congress $25,000 was appropriated to make the initial experiment under the auspices of the Forestry Bureau of the U. S. Department of Agriculture. Mr. William L. Hall, who has charge of the Appalachian Mountain Forest Reserve, is to report on the feasibility of the experiment.

Tunneling Operations in New York City and Vicinity.*

BY H. T. ILDAGE, NEW YORK, N. Y.

Although Greater New York does not bear any resemblance to a great mining district, the mining operations that are being conducted in and about the city are both extensive and interesting in character. With regard to the extent, it may be mentioned that, at present, there is more dynamite used in New York than in any mining district in the United States; that there are under construction about 38 miles of tunnel, and that 66 miles more are projected, most of which must be constructed in the near future; that since 1902 at least 2,000,000 tons of earth has been removed in underground work, in addition to about 3,500,000 tons that has been removed in open-cut in connection with tunnel-work, and many times this quantity that has been removed in excavating foundations for buildings not connected with tunnel-work; and that there are today probably more than 5,000 men engaged in mining-work in and about New York City. These undertakings include almost every operation connected with underground work, from exploration by means of trench and boring, to the sinking of large shafts and the driving of large tunnels through every kind of ground from hard rock to soft, semi-fluid silt and quicksand.

Figure 1 shows the tunnels that are now under construction. A complete and detailed description of the tunnel-work that is being done and has been done in New York City during the last few years would form an important treatise on the art of soft-ground tunneling at least, and is entirely beyond the scope of this paper, which will, however, perhaps serve as an introduction to more complete papers recently published or to be published.

Location and Exploration.—Although the methods that are used in the exploration and development of a mine are essentially the same methods, perhaps somewhat specialized, as those used in the location and construction of a tunnel, and although most tunnels when completed are expected to fulfill at least one important function of a mine, that of yielding more or less profit to its owners, the considerations that govern the location and the nature of the development-work of a mine are essentially different from the considerations that govern the location, depth, size and number of tunnels.

Generally speaking, the depth, direction and position of a tunnel are, unlike the workings of a mine, fixed quite independently of the nature of the ground. The avoidance of steep grades and sharp curves, and the entrance into a terminal that is located in a position suitable to the convenience of passengers and at a convenient level, are the ruling conditions in fixing the depth, direction and position of tunnels. When the tunnel engineer becomes connected with a contemplated work, all these factors are more or less fixed, and although he may have some discretion with regard to depth, he is usually called upon to drive a tunnel in a certain position regardless of the nature of the ground, and he cannot deviate very much from the line and level given to him in order to get into more suitable strata.

The exploration-work for a tunnel differs from the exploration-work of a mine, inasmuch as its object is to explore the ground within a very limited distance of a certain imaginary line and not to seek suitable strata. This work consists of sinking a number of wash and core borings and trial pits on and near the approximately fixed center line of the contemplated tunnel, of such depth as to give as full information as possible concerning the strata through which the tunnel must pass and upon which it must lie.

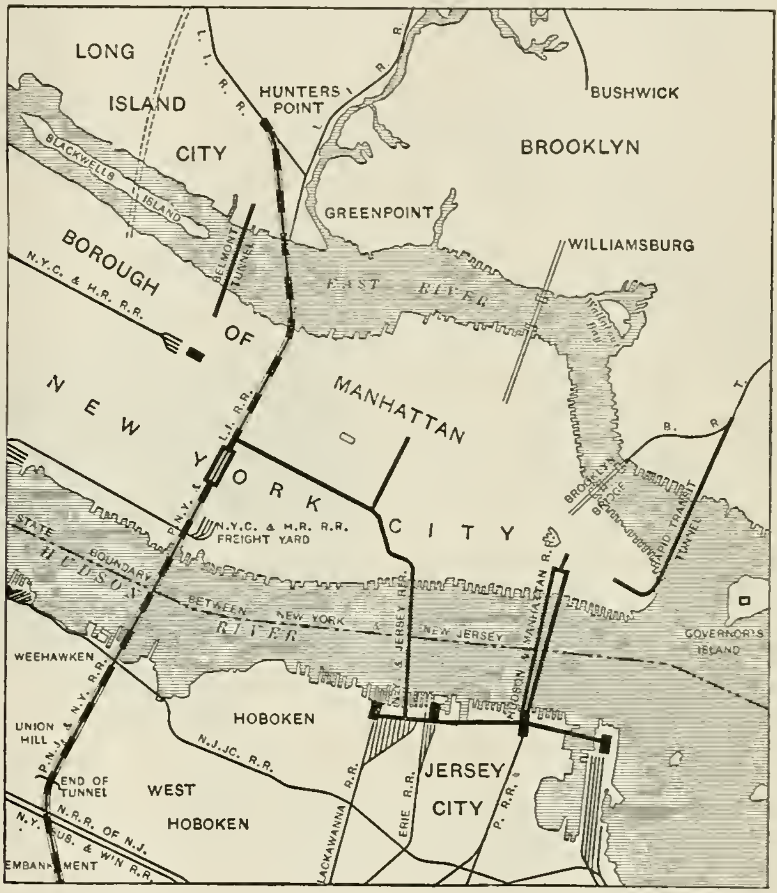

Fig. 1.—Map showing Tunnels under Construction in New York City and Vicinity.

It is true, as in the case of a mine, that although the exploration work is usually carefully considered and is often quite elaborate, it very often does not reveal some very important geological feature or has to be supplemented during the course of construction.

To take one example, 147 core and 330 wash borings of an aggregate depth of 23,000 ft. were made to explore the ground through which the Pennsylvania tunnels were to be driven, and subsequent work has shown these borings to have been accurately taken; yet the design of the work had to be modified in some important particulars because the ground through which the borings passed was not representative of the neighborhod; and an additional series of borings has had to be taken from the interior of the tunnels under the North River for the purpose of exploring the ground lower down in order to discover suitable material for foundations. The design of the Weehawken shaft had to be radically changed, because in the course of excavation it was found that the contact of the trap of the Palisades and the sandstone occurred at this point. The methods of construction of the tunnels across Manhattan were modified for similar reasons. It was originally intended to tunnel from Ninth avenue to Eleventh avenue without disturbing the surface of the ground, as the borings apparently indicated that the rock cover was sufficient but not very heavy. It was found, however, that the rock roof thinned out and in places disappeared, and on this account it was decided to build the tunnel by cut and cover methods.

When all the borings have been taken

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*Abstract of a paper read before the American Institute of Mining Engineers.

along the line of a tunnel about to be built, the center line and grades are definitely decided upon, and, if it has not already been done, the position of the shafts is fixed and the sinking is commenced.

Shafts.—The first shaft sunk for the Hudson tunnel, in Jersey City, was of brick and about 23 ft. in diameter. It appears that the location of this shaft was chosen mainly in order to make the tunnel as short as possible. Consequently, it was built entirely in soft ground. An air lock was built in the side of the shaft and tunneling started from there, but while the connection between the shaft and the tunnel was being completed and made safe, an accident happened that disabled this air lock and shut off access to the tunnel. A timber caisson was then sunk alongside the shaft, and by means of this the two single track tunnels were commenced and safely connected with the shaft, which was used for all subsequent work. The Morton street (New York) shaft for the same tunnel was a timber caisson 27 ft. 6 in. by 46 ft., and 26 ft. deep from the top of the deck to the cutting edge. This caisson, entirely in soft water-bearing ground, spanned both tunnels.

Access to the tunnels of the Pennsylvania Railroad Co. was obtained at the portal of the Hackensack meadows and through shafts located in the following places: Weehawken, in the Erie yards, near Baldwin Ave.; Manhattan, between Thirty-second and Thirty-third streets, at Eleventh Ave.; at Thirty-second and Thirty-third streets (two shafts), between Fourth and Madison avenues; between Thirty-second and Thirty-fourth streets, near First Ave.; and Long Island City, one shaft in the river in Nassau slip, one on shore near the bulkhead, and others at East Ave. and Borden Ave.

The considerations that fixed the positions of the river shafts, apart from local conditions, were the desirability of shortening as much as possible the river tunnels and of having them start out in good ground.

The Weehawken shaft of the Pennsylvania tunnel, 56 ft. by 115 ft. 9 in. at the bottom and 76 ft. deep, is lined with concrete from top to bottom. It is on the center line of the tunnels. The ground is mostly rock. The Manhattan (North River) shaft, 22 ft. by 32 ft. and 55 ft. deep, is lined with concrete and steel down to the surface of the rock. It is about 100 ft. from the center line betwen the tunnels, and is connected with them by a cross heading. The upper part is in made ground, the lower part in rock.

The shafts between Fourth and Madison avenues, on Thirty-second and Thirty-third streets, 20 ft. by 30 ft. and 96 ft. deep, are not lined, being entirely in sound rock. They are 50 ft. from the tunnels they serve, and are connected therewith by cross headings 20 ft. wide.

Each shaft for the East River tunnels serves two tunnels. The linings are 48 ft. by 74 ft., and it was originally intended if the rock were sound not to continue the linings into the rock. The shaft linings were so designed, however, that if the rock were unsound or unreliable, the lining could be continued to the full depth of the shaft, and the upper part built up so as to be above the surface of the ground. In case it should be necessary to continue the lining to the full depth of the shaft, "eyes" were provided through which the shields could be driven, and temporarily stopped with steel plates stiffened with horizontal girders. Each shaft has double walls of steel plates about 5 ft. apart, connected and stiffened by girders, the spaces between the walls being filled with concrete. The shafts on the Manhattan side rest on the surface of the rock, but on the Long Island side it was necessary to sink them into the rock to the full depth, involving the use of compressed air.

In general, the shafts are shallow, rarely exceeding 100 ft. in depth, and, wherever possible, arranged so that tunneling can be commenced without the necessity of using compressed air. Where compressed air has to be used in starting the heading, caissons are utilized.

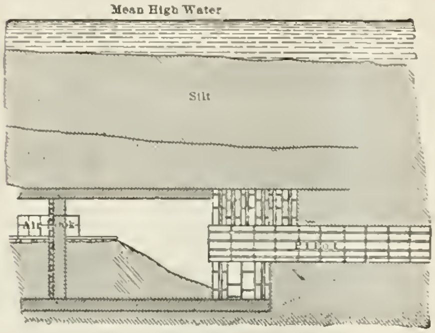

Fig. 2.—Longitudinal Section of Old Hudson Tunnel.

Tunneling.—The difficulties of starting the heading from the shaft depend not only on the ground in which the heading will lie, but also on the ground through which the shaft has passed. Even if the heading be started in good ground, there is always the possibility that the sinking of the shaft has so disturbed the ground all the way up that the water and loose material from above may come in when an opening is made. This is what occurred at the commencement of the old Hudson tunnel. In bad ground it is always difficult to make a large vertical opening, and to protect the face at the same time. Moreover, difficulty is encountered in making a good joint between the tunnel and the shaft. In every recent case in and about New York City either the heading has been driven in good rock or the commencement has been safely accomplished under compressed air, but when the old Hudson tunnel was commenced, several serious accidents occurred in starting the heading and in making the joint between the tunnel and the shaft.

The full face rock tunneling work that has been and is being done in New York City is very similar to other rock tunneling, and it is not necessary to discuss it here further than to mention a new method that has been used for driving the heading. This method is designed for driving under streets, in the neighborhood of heavy buildings and in other places where it is necessary or desirable to reduce the shock caused by blasting to a minimum. It consists of making the first break into the solid rock face by cutting a vertical channel into it and then splitting away slabs of material by exploding vertical lines of holes on each side of the cut. This method would be very attractive, being more scientific and less brutal than firing two vertical rows of converging holes all at once to throw out the wedge-shaped piece of rock between them; but it has been found in practice that the benefits obtained even for driving headings in places where heavy blasting cannot be done, and where it is necessary to reduce shock and vibration, are not sufficiently valuable to offset the loss in time, as the same result may be obtained by increasing the number of holes and by firing relieving cuts.

The soft ground tunneling in the neighborhod of New York City is unique in several ways, and a brief description of the difficulties encountered and the methods used to overcome them is of interest.

The bed of the North, or Hudson River, composed chiefly of a compact silt containing about 33 per cent by weight of water, flows readily under pressure. It is almost impervious to air and water and is of about the consistency of putty. This material at first presented almost insuperable difficulties to the tunnel builders, but is now probably the easiest material through which to tunnel. The first successful method used was that of the "pilot" tunnel, illustrated in Fig. 2 which was devised for that work by Mr. J. F. Anderson, one of the original builders of the Hudson tunnel. This tunnel, the interior dimensions of which were 16 ft. wide by 18 ft. high, consisted of a very light wrought iron shell in segments, lined with about 2 ft. of brick work. A pilot tube about 5 ft. 6 in. in diameter was driven from 15 to 20 ft. ahead of the working face. The tube, made up of wrought iron plates, was erected one plate at a time, the plate being put in and bolted up as soon as a hole had been excavated to receive it and before the silt closed in again. The thin wrought iron shell of the large tunnel was erected in the same way, each plate being held in position by a radial strut from the pilot tunnel. The brick work was built inside the wrought iron shell in lengths of 10 ft. at a time. In this way as much as 90 ft. of tunnel has been built in a month. When the work was first taken up by S. Pearson & Son, it was continued by the old methods. It became, however, more and more difficult as the deepest point in the river bed was approached. The company therefore designed and constructed the shield to complete the work, and initiated methods that have been very successful in tunnels since built. The method of tunneling through soft ground by means of the shield process has already been successfully used in England, and has been exclusively used in New York. It will be interesting to trace briefly its evolution as far as it has gone on the work in this vicinity.

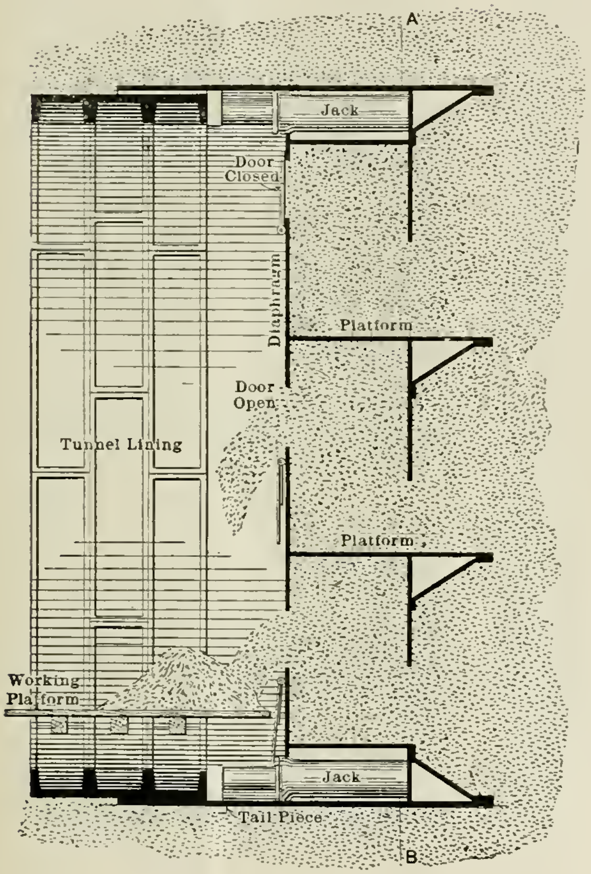

Fig. 3.—Shield for Continuation of Old Hudson Tunnel.

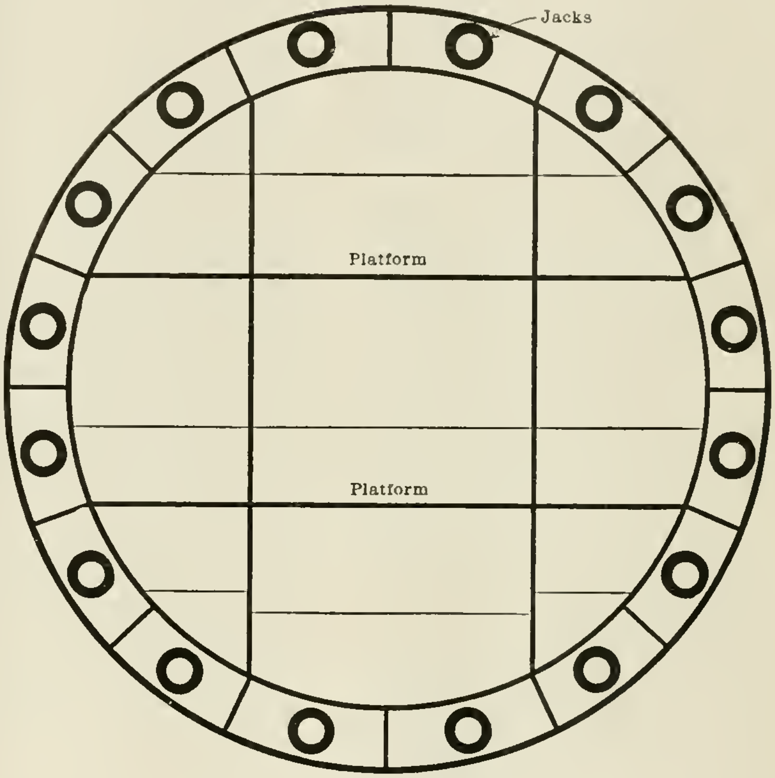

Fig. 4.—Section through A-B of Shield Continuation of Old Hudson Tunnel.

In general, a shield for soft ground tunneling is a means of avoiding the poling of the roof and sides of the excavation, and of facilitating and supporting the poling of the face, and forms a cover under which the lining may be erected. It consists essentially of a steel cylinder fitting rather loosely over the outside of the tunnel lining, under the protection of which the lining can be erected and the face poled if necessary; it must be provided with some means of propulsion, usually hydraulic jacks.

In most cases an inner shorter cylinder is added for stiffness and connected to the outer by radical diaphragms. In the cells thus formed are placed the hydraulic jacks that react against the tunnel lining and push the shield ahead. When good ground is being tunneled, the space inside the inner cylinder is left open, permitting unrestricted access to the face, except in so far as this is prevented by the vertical partitions usually necessary to stiffen the ring, and the horizontal platforms for the men to work on. If the ground is bad, the face is closed by a diaphragm in which are doors giving access to the face through the "pockets," into which the shield is divided by the vertical and horizontal partitions. When the shield is designed for ground in which it will be necessary to work in front of the shield, to pole the face, for instance, in gravel, or to remove piles, boulders or other obstructions, or to blast out rock the outer cylinder, known as the "skin," is extended forward further at the top than at the bottom, forming a hood, under the protection of which the men can work, and which also relieves them of the necessity of caring for the roof. If the hood extends for at least two-thirds of the depth (which should always be the case), poling at the sides also is avoided and the only poling to be done is at the face.

The length of the shield depends upon the length of tunnel lining erected at one time. In the case of cast iron or steel lining, the "tail," or that part of the skin that can lie behind the lining, is usually made of such length that when the shield is advanced and ready for the erection of a ring, one and a half rings of tunnel lining are under its cover. The length of the inner cylinder is determined by the length of the jack cylinders, which is a function of the length of a ring of tunnel lining. The length of the hood, if one is used, should be about 15 ins. greater than the distance that the shield is advanced at a time. This will depend upon the nature of the ground and the length of a ring. In very bad ground, it may not be possible to advance the polings more than a few inches or a foot at a time, but in better ground a full ring length may be made.

There are certain accessories added to shields, such as erectors, sliding platforms, face shutters, etc., that will be described with the shields on which they are used.

The shield designed by Mr. E. W. Moir and used by S. Pearson & Son in the Hudson River north tunnel, shown in Figs. 3 and 4, consisted of a steel shell, or skin, stiffened by an inner shell, and was driven by jacks. The interior was closed by a diaphragm in which were nine hinged doors. The method of working was as follows: Some of the doors of the shield were opened and power turned on to the jacks. The shield moved slowly ahead, laying bare as it went the "tail," which had been lying over the outside of the lining, and ultimately giving, when the jacks were returned, space for the erection of another ring. The silt squeezed slowly in through the open doors and falling upon the platform was loaded into cars and removed. As it moved slowly ahead, the progress of the shield was gauged at various points around the circumference, and when it had traveled the full length of a ring, the doors were closed, the invert cleaned out and the ring erected. This was done by means of a hydraulic erector that trailed behind the shield on rails supported by the iron lining. This erector consisted of an arm revolving on a pivot by two hydraulic jacks, and carrying a third hydraulic jack, the ram of which was fitted with a jaw capable of being attached to one of the tunnel segments. The whole arrangement was mounted on a carriage with four wheels.

The shield method of tunneling proved much more successful than the pilot tunnel method, and with it from 7 to 10 ft. per day were built in the Hudson north tunnel.

A modification in the method of working the shield was made when it was found possible later in building the south tube (Hudson tunnel) to push the shield ahead with the doors closed, consequently taking in very little if any silt. This modification reduced the operation of tunneling to two parts: shoving the shield ahead and erecting the iron ring. As much as 50 ft. of tunnel per day was built in this manner. Later, in the Pennsylvania tunnels it was found impossible to control the shield and maintain the line and the grade if the shield were shoved with closed doors, and for good work it was necessary to take in a part of the silt through the doors. If this were not done, the shield rose above the grade and could not be kept down, and the tunnel itself rose considerably after construction. The amount taken in varied from 20 to 100 per cent of the volume of the tunnel. The North River silt is so mobile that it would be quite easy to raise or lower a tunnel built in it considerably, and thus change or correct grade and perhaps alinement.

With the methods above described the process of tunneling through a full face of silt has become safe, quick and easy, and it does not appear that much further improvement can be looked for except in mechanical details—handling muck, shield, rams, and erecting iron—and organization.

When the shield was not entirely in silt, difficulties appeared that necessitated further revision of methods and considerably reduced the rate of tunnel building. When the north Hudson tunnel had been driven about 4,000 ft. it was found that there was a ridge of rock through which the tunnel would have to be cut, and it turned out subsequently that the rock rose in places as much as 16 ft. above the invert. This was the first time in the history of tunnel driving that it had been necessary to blast out part of a face of rock, and at the same time prevent an inflow of soft earth. To overcome this difficulty a horizontal platform was built in the shield about 8 ft. above the invert and projecting about 2 ft. in front of the shield, supported by raking struts from below, to carry the roof of the excavation Then that portion of the silt between the platform and the surface of the rock was held up by poling boards strutted to the shield, while the rock in the invert was blasted out with light charges of dynamite.

This method of working was generally satisfactory, and by its use from 2 to 4 ft. of tunnel were built per day. One difficulty that frequently occurred in connection with this work was what is technically called a "blow." The air pressure in the tunnel, about 35 lb. per sq. in., was found to be satisfactory when ordinary progress was made, any lowering of this pressure allowing the silt to flow excessively. If, for any cause, the shield was kept standing in the same place for a day or two, the silt seemed to soften considerably for some reason or other, with the consequence that when progress was resumed and the shield shoved ahead, the air escaped, usually betwen the tunnel lining and the shield skin, with a loud roar, carrying with it the soft silt, and opening up communication with the river; the pressure in the tunnel fell, the atmosphere became foggy, and unless the escape of air was speedily stopped by stuffing bags of sawdust, clay, or other material into the hole, a point was soon reached when the escape of air began to be accompanied by a heavy inrush of water. This was followed by a rise in the pressure which soon caused another blow, and so on until the tunnel was full of water.

These occurrences were rather alarming and delayed the work considerably, but very seldom, if ever, caused loss of life. They could be and were either prevented, if they seemed imminent, or cured, after the tunnel was flooded, by blanketing the river bed at the spot where the "blow occurred. One or two barge loads of good clay were dumped just over the shield, and this replenished the "cover" that had been or was in danger of being blown away.

Another trouble, and one that was doubtless partly responsible for the occurrence of blows in the Hudson tunnels, was that every time the shield was advanced the face was lost and the silt flowed into the "pockets" of the shield and through the doors. This delayed the work by making it necessary to clean out the pockets of the shield every "shove," and contributed to the production of blows by denuding the tunnel of just that amount of "covering" clay. This trouble was avoided in the Pennsylvania tunnels by the method of working there adopted. The face above the rock was held by vertical poling boards, and as these were advanced they were strutted against the shield. When the face was completely poled, horizontal walings were put against the polings and held in place by the sliding platforms provided, and by struts which passed through the shield against the tunnel lining. The necessity for supporting the poling independently of the shield was recognized early in the driving of the Blackwall tunnel in London, England, and it has been used in every tunnel of that kind driven in England since. The design and position of the shield (the shield had rolled on its axis about 45°) in the Hudson north tunnel prevented it being used there, but it was used in the Morton street extension and probably in the Hudson south tunnel.

The methods of working described above refer only to tunnels built entirely in silt or part in rock and part in silt, but entirely in ground that is impervious to air and water.

(To be continued.)

Itemized Cost of Burnettizing Timber and Ties.

The following data relate to the cost of treating timber by the zinc chloride process, known as burnettizing. The extremely low cost of preserving timber in this manner will doubtless astonish many of our readers who are more familiar with the relatively high cost of creosoting. In this article we shall show that burnettizing costs about $2.50 per 1,000 ft. B. M., or 3 cts. per cubic foot; and in a subsequent article we shall give similiarly detailed figures showing a cost of $16 per M. or 19 cts. per cu. ft.

The plant has a capacity of 2.500 ties per day, and the following is the average cost of a year's work:

	Cents per cu. ft.
0.3 lb. zinc chloride at 3.8 cts........	1.14
Fuel at $3.50 per ton................	0.25
Oil, etc.	0.06
Current repairs	0.10
Switching engines, etc...............	0.10
Depreciation, 10% of $75.000 plant divided by 2.500,000 cu. ft............	0.30
Labor	1.05
Total per cu. ft.................	3.00

The ties were 7x9 ins. by 8 ft., containing 3.5 cu. ft. each, hence the cost per tie and per 1,000 ft. B. M. was as follows:

	Cents per 7x9 tie.	Per M ft. B.M.
Zinc chloride, at 3.8 cts. lb..	4.00	$0.95
Fuel	0.87	0.21
Oil, etc.	0.21	0.05
Current repairs	0.35	0.08
Switching engines, etc.....	0.35	0.08
Depreciation	1.05	0.25
Labor	3.67	0.88
Total	10.50	$2.50

The amount of zinc chloride per cubic foot is somewhat less than is commonly used, being 0.3 lb. as compared with 0.4 to 0.5 lb. per cu. ft. For comparative data the reader is referred to Rome's "Preservation of Timber," page 177.

Camp's Track, page 948 et seq., gives some rather vague cost data, but contains good information as to the life of burnettized ties.

Methods and Costs; Some Old; Some New.

Road Roller Repairs.—The Massachusetts Highway Commission had last year under its control 16 steam road rollers. In 1906 the total days' work of the road rollers was 1,719.5, an average of 107.5 days for each roller. The total cost of maintenance for the year was $2,468.96. Of this sum $1,725 was paid for practically rebuilding two of the rollers, which had been in active service since 1896-97 The sum of $743.96 was expended for ordinary repairs. Including the expense of supervision and inspection of the rollers, the average cost of such ordinary repairs was 98½ cents per day for each roller in use.

Operating Submerged Pumping Engine.—Extreme high water in the winter of 1907 flooded the pumping plant of the Water Department of Duquesne, Pa., so that the pumps were covered to a depth of several feet. The boiler room was also flooded and the fires put out, making it necessary to operate the plant by steam obtained from other sources, and with the pump under water. The pump was a 1,500,000 gallon per 24 hours compound duplex condensing engine and during the flooding it was worked with free exhaust and under 25 feet of water. The method of doing this was given by Mr. E. Forrest Williams at the recent convention of the American Water Works association, and was as follows: Two large locomotives were placed as near to the pump station as possible, the distance being about 300 feet from the pump. The engines were connected with the steam line in the building by two 2 in. lines. These steam lines were suspended over the water by wire cables., and were connected to the steam line at the top of one of the regular boilers from which a 5 in. steam line ran down through 30 feet of water to the pumps. A raft was anchored over the engine and from this raft the engines operated the throttle valve. Steam was turned on and after the engine had cleared itself of condensed steam, it started up and pumped 540 gallons of water per minute aganist a head of 423 feet. The pump was operated in this manner for 36 hours.

Construction of Submerged Sewer Outlet.—The following method was used by Robert R. Evans, city engineer of Haverhill, Mass., in the construction of a submerged outlet for a sewer: The iron pipe was calked together on shore, and the ends stopped by wooden plugs held in place by a wire cable running through the pipe. In this condition the pipe would nearly float, and was easily handled. On the rising tide a scow was floated alongside the pipe which lay just above low water mark, and lines attached so that the continued rise of the tide, lifted the pipe. The scow was then swung into place and the pipe lowered, by slacking off the lines, into the channel which had been dredged for it, a timber guide serving to properly locate the in-shore end. In this way 120 ft. of pipe was easily handled in one length. When the pipe was placed, an earth dam was thrown up around the in-shore end which extended beyond low water mark, and at low water the trench was pumped out and the necessary pipe laid to connect with the portion of the outlet above the water mark, which had been built previously, the pressure of the water serving to hold the plug in the outer end, when the inner plug was removed.

Placing Mortar Facing.—In the construction of all concrete abutments built during 1906 under the supervision of the Massachusetts Highway Commission, a mortar made of a mixture of 1 part of cement to 1 part of sand was used on the face to a depth of 1½ ins. This was placed by using the thin metal diaphragm (shown in Fig. 1), separating the richer front mortar from the standard concrete, and withdrawing the diaphragm when the concrete was in place and before it had set appreciably. Usually three of these diaphragms were found necessary to carry on the work properly.

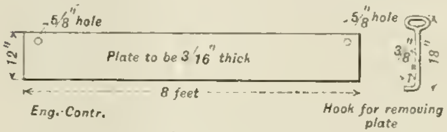

Fig. 1.

Another method of placing mortar facing has been largely used in the West especially, during the past few years. The mold used consists of a sheet iron plate 8 ins. wide and about 6 ft. long having riveted across it on one side 1½ in. angles spaced about 2 ft. apart. One edge of this plate is provided with handles as shown in Fig. 2. The method of operating the mold is as follows: The plate is set up against the face of the form with its angle ribs close against the timber. In this position there is an open slot 1½ in. wide between the plate and the form. This slot is filled with mortar which is tamped thoroughly and immediately afterward the concrete backing is deposited behind the plates. The plate is then withdrawn by the handles and the backing and facing rammed together to a close bond. The essential principal in this method is to secure as nearly as possible the simultaneous construction of the concrete backing and the mortar facing. It will be noted that by varying the size of the angle-ribs any desired thickness of mortar facing can be constructed.

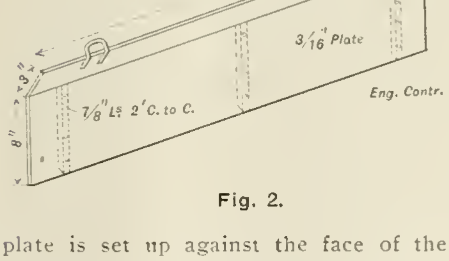

Fig. 2.

Cinder Roads.—Several miles of road have been constructed of soft coal cinders in and near Council Bluffs, Ia. This material was used owing to the lack of stone suitable for macadam, the limestone in that neighborhood being nearly worthless for that purpose, and suitable stone being far distant. The method of constructing these roads as given in a letter to the editors from Mr. W. F. Baker, Supervisor of Pottawattamie County, Iowa, is as follows: "We use about 800 sq. yds. of cinders per mile and this leaves them about 5 ins. thick and 10 ft. wide upon the surface of the road. We then plow the roadbed to a depth of about 5 in. below the cinders and 10 ft. wide, thus thoroughly mixing the cinders with the dirt,—about one half of each. We then use a blade grader moving this mixture outward from the center to the depth plowed and 10 ft. wide, finding a smooth hard surface that is rolled thoroughly. We then move this mixture back with our grader, spreading it evenly over this hard surface about 2 ins. thick at a time, following each layer with a heavy roller, thus building up till it conforms to the road-bed upon each side, and sloping from the center outward about 1½ ins. to the foot. Cinders cement equally well with hill clay, black soil, or gumbo, but not so well with sandy soil. We have had this system of road in use over one year where there has been exceedingly heavy traffic with narrow tires and we believe it is equal in durability to macadam, much easier and more cheaply repaired and costing not to exceed one tenth as much in this locality. This road-bed is not only exceedingly hard but tough so rubber tires do not pick it up and when displaced with shoe corks, it cements again under pressure while rain has no effect upon it. This form of road leaves a dirt road on each side for the travel in dry weather, which I considered very important. As to the cost, if you were to pay 25 cts. per yard for the cinders, and then haul them from one to two miles to your road, your road when completed would cost not to exceed $500 per mile."

Bids on contracts amounting to about $9,000,000 for work on the New York State Barge Canal will be asked soon. Plans for the work were approved some time ago and the delay in calling for bids is said to be due to the failure of the attorney general to approve the form of contract.

Recent Progress in the Asphalt Paving Industry.*

BY CLIFFORD RICHARDSON.

(Continued from June 26 issue.)

One of the greatest advances in the industry of late years, which has been rendered possible by the enormous development of the Portland cement industry in the United States and the consequent reduction in price of this material, is the construction of the foundation with this more impervious material. It may be safely said that no asphalt, or in fact any other form of pavement, can be considered of standard form unless it is supported on a Portland cement concrete base of suitable thickness. It would seem that this must have been self-evident for years, and provision for such a construction has been very general, but it is still too often neglected. In the Borough of Manhattan, New York City, the condition of the asphalted streets to-day, and it must be confessed that it is not satisfactory, is entirely due to the fact that they have, as a rule, no proper foundation. There are but two or three streets which have a suitable base of Portland cement concrete, among them Fifth Ave. and Park Row, while the intermediate course between the foundation and the surface in these streets is such a weak one that it is surprising that the surface has worn as well as it has during its ten years' use on Fifth Ave. Almost all of the sheet asphalt streets of the Borough of Manhattan are laid on old stone pavements, many of them on stone blocks which have been disturbed and turned upon their broader side, thus causing great instability and tendency to vibration in the bituminous surface, which eventually results in its disintegration. This practice originated in the introduction of asphalt pavements into the Borough before 1890, when, for motives of economy and because the streets which were paved were those only on which residences abut and of the lightest travel, the old stone pavements were regarded as suitable for foundations. As a matter of fact, they were so to a certain degree; but with the extension of asphalt surfaces to the more heavily traveled streets, this iniquitous practice, for which there was no justification other than economy, was continued, with the result which we see to-day.

No stronger contrast, nor one showing more strikingly the difference between asphalt pavements with suitable and unsuitable foundations, can be asked for than a comparison of the behavior of pavements of this type in the Boroughs of Manhattan and Brooklyn. In the latter borough a suitable Portland cement concrete foundation has been very generally provided in contrast to the weak bases employed in Manhattan, with results which are very evident. This, too, is more striking when it is known that the asphalt mixtures which have been laid in Brooklyn are not of the high standard that they might be. The less satisfactory mixtures have done better in Brooklyn on a well-constructed base than the high grade mixtures in Manhattan on weak bases, for it is a fact that the greater part of the mixtures which have been laid in the latter borough since 1896 has been the ideal one corresponding in composition to that which has been previously described. It is astonishing that the municipal authorities, who are responsible for the construction of the asphalt pavements in Manhattan, do not seem to be alive to the situation in this direction and in another which will be described. On the contrary, the results of the use of an inferior base do not seem to have any impression on them.

With a suitable Portland cement concrete foundation and a wearing surface of the standard type, every provision for a lasting form of asphalt pavement for streets which carry a heavy and continual traffic, such as that supported by Fifth Ave. in New York, which at its busiest hour amounts to more than 14,600 per day of twelve hours, has not been made. It is equally important that the intermediate course between the surface and the foundation should be of rigid construction. This course, as it has been used since 1889, was an inheritance from the old coal-tar pavements of Washington, D. C. The base in this pavement consisted of large broken stone, 2½ ins. in size coated with tar. The interstices in the surface of such a foundation were necessarily large, and it would not have been economical to use a fine surface mixture of sand and tar directly upon it, as much would have been lost therein. It was the custom, therefore, to apply a course of finer stone of about 1 in. size, coated while hot with melted tar, thus obtaining a surface which was close and sufficiently smooth to permit of applying the surface mixture without great loss. This was known as a binder course.

The earlier asphalt pavements were of a form of construction which provided for the application of the surface mixture directly to the hydraulic concrete foundation. These early mixtures were not prepared on other than an empirical plan and were not stable. With nothing to tie to on the smooth foundation, they were very apt to push out of shape, and become very wavy under travel. When, in the year mentioned, it was decided to abandon the laying of coal-tar pavements in Washington, the only change possible under the law, which specified that not more than a certain price should be paid per yard, was that the base and binder courses should remain as in the tar pavements, but that an asphalt surface should be used. This form of construction was found to be so desirable, and to do away so satisfactorily with displacement of the surface under traffic, that it was generally adopted elsewhere and became a permanent feature of asphalt pavements. It served very well for years and does so today on streets where the travel is not excessive; but when this form of pavement began to be applied under more trying conditions it failed, and more particularly where the foundation was not a rigid one. The binder under such circumstances, under very heavy loads, such as coal trucks carrying as much as seven tons of coal and similar loads, was either displaced, or crushed if the stone of which it was composed was not an extremely hard rock, or the surface was forced by the heavy traffic into the voids in the binder course, thus disintegrating the pavement.

One of the greatest improvements in the last few years, but unfortunately one which has been adopted only to a limited extent, owing to the inertia of our municipal engineers, has been the change from a binder containing a large volume of voids, and consequently very unstable, to an intermediate course composed of the same stone as the old binder, but with the voids completely filled with the fine mixture used for the surface course. With a material of such composition, well cemented with a bituminous cement, a perfectly stable course is obtained between the foundation and the surface, which is capable of sustaining the surface under any travel to which it may be subjected, without the slightest vibration. Naturally it increases the cost of the pavement slightly, but the advantages gained more than make up for this, as a surface thus constructed will have a life increased in amount more than sufficient to bring the cost per year below that of one built on the old lines. It is the most important advance within the last ten years in the asphalt paving industry, and one which should receive more attention than it has up to the present time. With such a form of construction a very different condition of affairs would be found in the asphalt pavements on the streets of New York, even if the old stone blocks continued to be used for a foundation. Unfortunately no steps have been taken to call for it in the specifications of any of the boroughs. As a matter of fact, Kansas City and Omaha are the only ones which have, up to the present time, as far as the writer is aware, approved of such a form of construction, although the desirability of it must be evident even to the layman. The inertia of municipal authorities is phenomenal.

Following the ideas which have been laid down as to the proper methods of constructing the different courses which go to make up an asphalt pavement, it will be of interest to see how they may be combined to make the most satisfactory one under different conditions which may be met. The most difficult problem is that of the street which is to carry the most continuous and heaviest travel. For this purpose a Portland cement concrete of at least 6 ins. in thickness is necessary, and an even thicker foundation if the subsoil base is not of the firmest character—that is to say, if the pavement is to be carried over soft ground, a recent fill, or where any particularly unfavorable environment is to be met. Under ordinary circumstances, 6 ins. of foundation is enough if it is constructed with a high grade Portland cement, such as is now readily obtained in the United States, and good hard stone, for which in many instances good gravel may be substituted. Every effort should also be made that proper drainage of the base should be provided to prevent upheaval by frost in northern climates.

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*A paper read before the New York Section of the Society of Chemical Industry, May 17, 1907.

Upon such a base 2 ins. of close binder, the stone of which should be hard enough to carry the travel without crushing, should be laid as an intermediate course, and on this a wearing surface of standard grading and made with a bituminous cement which consists of a mixture of suitable bitumens, skillfully combined and handled, to the depth of an inch and a half. A thicker surface is unnecessary if it is carefully prepared and laid, owing to the rigid character of the support; thicker ones, 2 ins., being demanded only on open binder and with poor foundations. Where the travel is light, the old-fashioned and common form of construction may be employed, although it will prove only a momentary economy, and in some residence streets an old stone or brick pavement may be economically and successfully used as a foundation.

In addition to the advances in the technology of the asphalt paving industry and in the form of construction of such pavements, there has been a distinct improvement in the plants which are in use for refining the crude asphalt and in turning out the binder and surface mixtures, which must be sent in a heated condition to the street. These improvements are largely in the line of economy and uniformity of production and in the type of portable plant which can be moved from place to place with little expense, for work in cities of the smaller size where the area to be paved does not justify the erection of a permanent plant.

At the larger refineries 250 tons of asphalt can be refined or dried in a day, for refining consists practically and almost entirely in the removal of water and the more volatile oils at a temperature of about 325° F. For this purpose the material is not subjected to fire, which might frequently be the cause of overheating it, but is heated by high-pressure steam in coils, and is agitated to accelerate the process by dry steam. In this way a very uniform and perfect product is obtained, none of which has been overheated or coked, and every lot of which can be used in the paving plant in exactly the same way and without varying the proportions of flux or of the asphaltic cement in use in the mixtures.

In place of the permanent plant which in the early days it was necessary to erect wherever a pavement was to be laid, portable plants upon railroad cars are now available, which can be moved to any point where work is to be done, and moved on again to the next point when it is completed. A very successful form recently introduced occupies but one flat car and can be set up and dismantled at small cost. This is a great advance over the two-car plant which was in use for several years, and which was very expensive to put in commission and to take down. The possibility of working in this way has rendered it feasible to undertake a much smaller amount of work in our smaller towns, which would otherwise cost a prohibitive price when done with a permanent plant. The result of all these economies which have been introduced into the industry, on the mechanical side alone, has been that sheet asphalt is now laid at prices very much lower than was the case but a few years ago, while the character of the work is much better, owing to the greater intelligence of those employed in the industry and the more scientific basis upon which it is conducted.

The pavement has now stood the test of years, thirty at least, a test which no other form has ever withstood with a success to be compared with it in the United States. More than 50,000,000 yards have been laid, and it is not surprising that in such an area some poor work has been done, even by the best contractors under unfavorable circumstances, and more by those not possessed of the requisite skill or expert supervision. The pavement is no longer a novelty, and the American people dearly love something new and experimental. Competitors constructing other kinds of pavements delight in criticizing it and in making comparisons of its merits with those of their own form, which is generally of an experimental nature. Nevertheless it continues to increase in area every year. In 1904, 4,849,731 sq. yds. were contracted for in the United States; in 1905, 5,912,375 sq. yds.; and in 1906 (to January 31, 1907), 7,241,721 sq. yds. In these three years it was laid in 110 towns of less than 50,000 inhabitants, and in 19 towns of between 50,000 and 100,000 inhabitants, while in 1906 it was introduced into 12 small cities where it had never been laid before. In spite of continued criticism of an unfavorable nature, its development is continuing. Such attempts to discredit it may, however, be regarded merely as a compliment, as it is only its success which compels this on the part of its opponents.

The greatest difficulty which retards the construction of a better form of asphalt pavement to-day is the fact that our municipal engineers do not understand the lines on which it is developing, and continue to demand the older form of construction or are taken by some novelty which has not been subjected to the necessary service tests for more than the shortest period. As it is, the asphalt pavements which are being constructed to-day, even on the old lines, are a distinct advance over those which were laid but a few years ago. The future of the sheet asphalt pavements is a bright one from the point of view of the technologist, the engineer, and the citizen.

Some Notes On the Use of Well Drills in Prospecting for Minerals, with Examples of Cost of Operation.

Well drilling outfits have entered the field of the diamond drill as a means of prospecting for ore bodies. Through the courtesy of Mr. C. E. Hart of Joplin, Mo., who has had extensive experience in prospecting with well drills both in the lead and zinc mining districts of Missouri and those of the Ely district in Nevada, we give here some notes on the use of well drills for this kind of work together with representation examples of the cost of well drilling operations.

Outfit Required.—The selection of the proper outfit for prospecting work should be given considerable thought. The first determining factor should be the extreme depth to which the drilling is to be carried. For depths from 100 to 300 ft. a Keystone No. 3 machine is very satisfactory and for depths from 300 to 500 ft. the same make No. 5 machine will be found to do most excellent work. For depths greater than 500 ft. one of the largest Keystone machines should be used. While for drilling ahead of a steam shovel from 10 to 60 ft. for blasting a No. 3 machine, with friction hoist, is all right, a machine with cog and gear hoist should be used for other purposes. These machines cost f. o. b. at the works, about $1,300 for the No. 3 and about $1,500 for the No. 5. A recent shipment of three No. 5 drills with a complete outfit of extra parts and fishing tools cost $4,792.17. It has been shown that these machines are an absolute, unqualified success wherever the ore is in large deposits or in blanket formation. "Just as accurate a record of the ground can be secured as with a diamond drill and at less than one-third the cost. There is no formation where they won't drill a hole, and samples have been taken from ground where the diamond failed to make a hole."

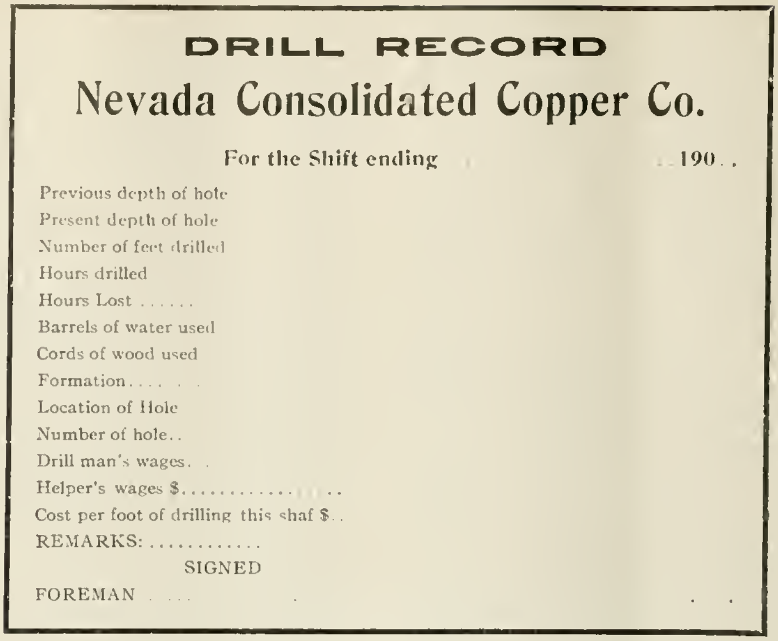
All machines should be fitted with traction road gear. With this gear a grade of 15 per cent can be safely mounted if the surface is hard enough to give traction to the rear driving wheels. If the ground surface is loose enough to allow the wheels to slip much the machine will sometimes stall on level ground. With mud hooks the machine can be sent through fairly deep mud providing it is not too stiff. A six-horse team will handle a No. 4 machine weighing 12,000 lbs., very nicely and a ten-horse team will handle a No. 5 machine weighing 18,000 lbs.

The equipment required for each machine will naturally depend upon the locality of its service. If the machines are to be used near a repair shop, the regular outfit furnished by the manufacturers is all that will be needed but if they are to be sent into country away from such facilities and from the railway quite a number of extras are absolutely needed. A complete set of fishing tools should be bought; if worked together one set will serve several machines. Spare parts should consist of extra injectors, gauge glasses, globe valves, belt lace, rubber belting bolts, a spare cable, four large inch screws, fan parts, extra boiler tubes, two bars of ½-in. and ¾-in. round iron. This list will have to be made up, however, according to the location of operations. It is always best by far to take along too many rather than too few parts. For holes of greater depth than 300 ft. it is advisable to have along a set of 10-in. bits to drill to say 200 ft. and than finish with the smaller bits.

Water, Fuel and Oil.—As these drills are operated by steam the question of water and fuel supply is an important one. Each machine requires an average of 8 bbls. of water on eight-hour shift. Where this has to be supplied by tank wagon and supply tank at each drill, it is found that an iron tank of 300 gallons capacity for the wagon is about as large as can be handled. A wooden tank 10 ft. long, 4 ft. wide and 3 ft. deep will supply enough water for two eight-hour shifts. These tanks should be set on runners made of 6x8-in. timbers so that they can be drawn after the drills when moving to another location. In the matter of fuel three-quarters of a cord of good wood or ¼ ton of soft coal will run a drill one eight-hour shift. Half a ton of blacksmith's coal will be ample for tool sharpening for a month unless the work is in very hard formation. One pint of cylinder oil and about the same quantity of engine oil will serve a machine for one shift. If a night shift is run coal oil must be provided.

Setting Up and Operating Drill.—Having moved the machine to the desired location it should be set level, with the fuel and the water tank within easy reach, and the derrick raised. Although means are provided for raising the derrick from the machine much the better way is to fasten the drilling cable where possible to a tree or rock some distance ahead of the machine and raise it with the engine; it is not nearly so hard a strain on the machine. After the derrick is raised the hole is started with a spud, and after the top and gravel are penetrated a piece of casing is put down to keep the hole open. No hole should be drilled deeper than 100 ft. without using the jars. The cuttings are pumped out with the sand pump every 5 ft., and water enough kept in the hole to make the drilling easy. If the hole caves it must be cased off until the formation will stand. It is well to provide an ample supply of 7⅝ and 5⅝-in. casing and some 10-in. casing. Some holes will be found that will need to be cased off all the way down and it is quite impossible to drill in soft ground without casing.

In arranging the work it has been found a great help in keeping the cost per foot down to run either three eight-hour shifts or two twelve-hour shifts. Much better results are secured in this way than by operating one shift per day. In the winter it is necessary to provide a shelter for the men. For this purpose a portable house to fasten together with straps and bolts will answer very well.



DRILL RECORD

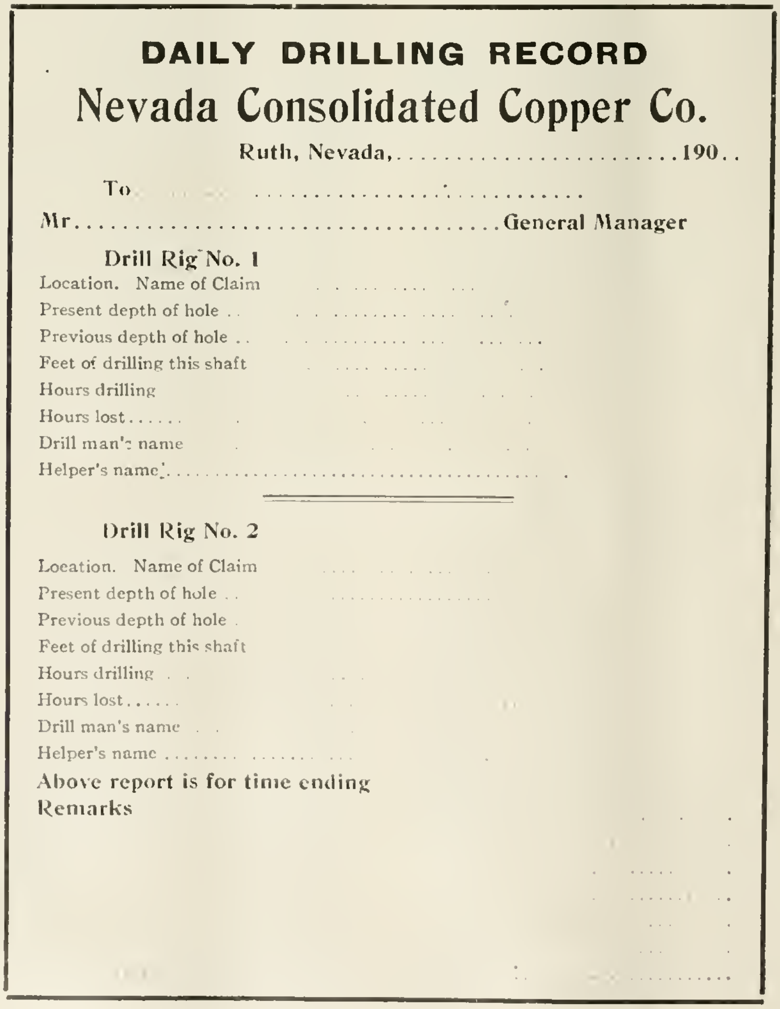
Nevada Consolidated Copper Co.

For the Shift ending ..190..

Previous depth of hole
Present depth of hole
Number of feet drilled
Hours drilled
Hours Lost ......
Barrels of water used
Cords of wood used
Formation....
Location of Hole
Number of hole..
Drill man's wages.
Helper's wages $..............
Cost per foot of drilling this shaf $..
REMARKS: ....
SIGNED
FOREMAN

Fig. 1.—Card for Recording Cost of Drill Work.

Recording the Drill Work.—Recording the work done in concise and convenient form is a very important item in prospecting with well drills. Daily time cards



DAILY DRILLING RECORD

Nevada Consolidated Copper Co.

Ruth, Nevada,........................190..

To ....
Mr..................................General Manager

Drill Rig No. 1
Location. Name of Claim
Present depth of hole ..
Previous depth of hole ..
Feet of drilling this shaft
Hours drilling
Hours lost......
Drill man's name
Helper's name...

Drill Rig No. 2
Location. Name of Claim
Present depth of hole ..
Previous depth of hole
Feet of drilling this shaft
Hours drilling
Hours lost......
Drill man's name
Helper's name ....
Above report is for time ending
Remarks

Fig. 2.—Card for Keeping General Record of Drill Work.

should be filled out by each drill man as he comes off the shift. Sample cards are shown by Figs. 1 and 2. The card shown in Fig. 1 is for recording the cost of the work and that shown in Fig. 2 is for keeping a general record of the work. From the daily time cards the superintendent makes up his report to the company at the completion of each hole.

For recording the formation in detail, a sample of the ground passed through should be taken every 20 ft. or at every change in the formation. This sample should be marked and put in bottles for future reference. After the ore is entered, most careful samples should be taken every 3 ft. In prospecting for gold, silver or copper these samples should be put in an iron tub and the water evaporated over a slow fire, after which they should be quartered down and sent to the chemist for the determination of their value.

In some cases it is even desirable to have a photograph of the hole and the formation penetrated. An apparatus has been perfected that will give a very good photograph of a hole, and show the ore in view if it is plain enough to make an impression. Photographs have even been taken with a moving film giving a continuous impression of the hole for over 100 ft. While care should be exercised in taking samples of zinc and lead it is not necessary to spend the same amount of time on them; it is seldom necessary to know their average value per ton, only the extent of the ore body.

A complete record of every hole should be kept in a book, with the exact location surveyed in, and a map made of the claim. On one page of the book the hole is drawn to scale, with all the different formations shown by colors and the changes of ground noted. On the other side of the page is a record of the hole. Date of commencement, completed, drillmen's and helpers' names, depth of hole, where water was found, assay of ore; total cost, cost per foot, and in general as complete a record as it is possible to obtain. It is desirable to have this book got up in the form of a loose leaf ledger so that the record may be made on a typewriter and duplicate made if desired.

Cost of Operation.—The cost of well drilling work for prospecting will, of course, vary widely. The location of the work in relation to source of supplies and repair positions, the season of the year in which the work is done, the formation penetrated, the rates of wages, etc., all influence these figures. In illustration of this fact the following general statements are given with two or three detailed records selected to show varying conditions:

Some drilling done at Ely, Nevada, this year in rhyolite reached a record of 54 ft. in eight hours or 6¾ ft. an hour. In porphyry, however, a good day's work was 1 ft. per hour including all stops. In the Nevada work the wages per eight hour shift was as follows:

Drillmen	$ 4.00
Helpers	3.25
Teamster and two-horse team	6.50
Teamster and four-horse team	10.50

In the Missouri lead and zinc field the figures are about one-third less. The contract price in Missouri for holes down to 200 ft. is from $0.90 to $1 per foot, and a greater rate for deeper holes. Drilling costs in this district about $0.65 per foot on an average. It was found in drilling some 6,000 ft. in Nevada that the costs averaged close to $3 per foot. A large part of the difference was for wood for fuel and in the cost of teaming; in fact the cost of hauling wood and water to the machines was nearly one-fourth the total cost. Wood cost at the drill $6 per cord and water cost 1 ct. per gallon. Blacksmith's coal and oil also cost more. As showing the two extremes of cost per foot the following detail costs of two holes are given from actual records:

Hole Drilled Through Lime and Flint in Missouri at a Contract Price of $1 per Foot.

Labor:	Total	Per Foot
2 drillmen at $3 per 10 hours		
2 helpers at $2.25 per 10 hours	$144.00	$0.7200
Supplies:		
Fuel coal	6.50	0.0325
Blacksmith's coal	1.00	0.0050
Oil, cylinder and engine	1.10	0.0055
Maintenance:		
Repairs and depreciation	7.40	0.0370
Total	$160.00	$0.8000

At the contract price of $1 per foot the construction profit was $40 or 20 cts., per foot.

Hole Drilled Through Rhyolite and Soft Lime in Nevada; Hole 280 ft. Deep.

Labor:	Total	Per Foot
3 drillmen at $4 per 8 hours		
3 helpers at $3.25 per 8 hours	$503.00	$1.796
Superintendence	162.10	0.587
Supplies:		
Fuel coal	147.00	0.525
Blacksmith's coal	9.10	0.033
Oil, cylinder and engine	5.25	0.019
Water	132.00	0.471
Maintenance:		
Repairs and depreciation	23.12	0.083
Total	$981.57	$ 3.50

As showing the effect of weather and formation on the cost of drilling two examples of work in the Nevada fields are given. In the first case the work was done in September with all the weather conditions in its favor and the drilling was through rhyolite which is an almost ideal formation for this kind of drilling, it drilling easily and being homogeneous enough to retain its shape without caving. In the second case the work was done in February, drilling through porphyry. The weather conditions were unfavorable and the porphyry was too soft to stand up under the rush of the water and caved badly. The cost of drilling in the two cases was as follows:

Drilling Hole 308 ft. Deep in Rhyolite.

Labor:	Total	Per Foot
1 drillman six 10-hour days at $125 per mo.	$ 24.18	$0.078
1 helper six 10-hour days at $100 per mo.	19.32	0.063
1 drillman, 17 8-hour days at $125 per mo.	68.51	0.222
1 helper, 17 8-hour days at $100 per mo.	25.76	0.084
1 helper, 17 8-hour days at $120 per mo.	36.00	0.117
Supplies and Miscellaneous:		
¾ cord wood per shift at at $4.50 per cord	77.51	0.251
8 bbls. water per shift at $6.50 per day	100.75	0.327
2 gallons oil per day	2.20	0.007
Blacksmith's coal, 200 lbs. at $54 per ton	5.40	0.017
Miscellaneous charges	162.65	0.528
Total for 308 ft. hole	$522.28	$1.694

Drilling Hole 160 ft. Deep in Porphyry.

Labor:	Total	Per Foot
3 drillmen at $4 per shift	$107.50	$0.672
3 helpers at $3.25 per shift	108.80	0.679
Superintendence	86.40	0.540
Supplies and maintenance:		
Blacksmith's coal	8.80	0.055
Oil, engine and cylinder	3.18	0.019
Water	72.10	0.451
Wood	72.10	0.451
Maintenance and depreciation	14.33	0.089
Total for 160-ft. hole	$473.21	$2.956

In the case of the second hole in porphyry six days' time were lost while waiting for casing. The rock caved badly, preventing the gaining of greater depth. More than one-third of the total time was taken up in casing the hole.

The Chicago Drainage Canal Work South of Lockport, Ill.

At a meeting of the Western Society of Engineers, held on June 21, Mr. Isham Randolph, M. Am. Soc. C. E., the retiring chief engineer of the Sanitary District of Chicago, gave a lecture on the work already accomplished and planned for the future on the extension of the Chicago Drainage Canal beyond the original terminus at Lockport, Ill. Incidentally Mr. Randolph pointed out that in this new work the idea had been kept in mind constantly that the present sanitary and water power canal would ultimately be a link in a great waterway from Lake Michigan to the Mississippi River and spoke a word in favor of the general development of waterways to supplement the railways of the country in their task of handling the rapidly growing transportation business.

The Chicago Drainage Canal ended originally at Lockport, Ill., 28 miles from Chicago. Here the water passed over a bear trap dam and through gates into the Desplaines River, which was widened at that point to receive the additional flow. The extension beyond Lockport reaches to Joliet, some five miles further. Its purpose was: (1) to develop hydro-electric power by taking advantage of the fall in the Desplaines River, and (2) to provide another link in the Lake Michigan-Gulf of Mexico waterway.

The extension to Joliet may be divided into three sections: (1) the headrace 10,700 ft. long with a minimum depth of 22 ft.; (2) the power house locks and safety dam; and (3) the tailrace below the power house.

The headrace is formed by an earth and stone embankment on one side and a retaining wall backed up by rock on the other side. Between these boundaries is cut the main channel 160 ft. wide and to such depth as will give the required 22 ft. depth of water. The distance between embankments is considerably greater than 160 ft., so that the headrace when filled will form a rather wide waterway with a channel 22 ft. deep and 160 ft. wide throughout its length. The object of this construction was to provide a large volume of water behind the head gates of the power house to reduce fluctuations of head due to locking vessels through when the waterway is operated as a ship canal.

The power house is a two-story concrete block building 386x159 ft. and provides for eight wheel pits and one exciter pit. Each wheel pit contains six wheels mounted on a common shaft. The forebay is protected from floating in by a concrete wall pierced with submerged arches. The deflected ice passes along the wall to a gate which is an interesting combination of a bear trap dam and a Tainter gate, and thence into the tailrace. Alongside this gate is the lock for the Illinois & Mississippi Canal and parallel to this lock a site is reserved for the larger ship canal lock which it is expected that the future will make necessary.

One of the most notable structures called out by this work is the safety dam provided to prevent the flooding of Joliet and the reaches below in case of a break at the head works. This safety dam was worked out in the shape of a large butterfly valve. This structure is located up stream from the forebay and when closed will shut off the flow of water completely. Briefly described, a truss bridge on two masonry piers is built up and down stream in the center of the channel which has an 80-ft. clear waterway on each side of it. The valve is a framework of steel 180 ft. long and about 32 ft. high sheeted on the upstream side with steel plates, which is pivoted vertically at the center. The bottom pivot sets into the masonry bottom of the canal and the top pivot is carried by the bridge truss. Nominally the butterfly will stand parallel with the canal between the piers. To operate it, the gates in one wing are opened, unbalancing the pressure on the two sides of the pivot shaft and swinging the valve across the stream. The device is an exceedingly simple one. This donation to the safety of the city of Joliet will cost some $200,000.

Itemized Cost of Two Howe Truss Bridges of 120 ft. and 130 ft. Span, Including Falsework and Pile Abutments.

In our issue of June 26 the cost of a Howe truss bridge of 150 ft. span built by company labor was given. The following data relate to a through Howe truss bridge 130 ft. long over all, for which a contract was let for the labor of erecting the bridge. The contractor paid bridge carpenters $2.75 a day and helpers $2.00.

The bridge was designed for a live load of engine and tender weighing 112 tons, followed by a train of 3,000 lbs. per lin. ft. The dead load was 1,650 lbs. per lin. ft.

The cost of the bridge to the railway company was as follows:

Falsework:	
840 lin. ft. piles (20 piles) delivered at 8 cts.	$ 67.20
840 lin. ft. piles driven at 12 cts.	100 80
24,000 ft. B. M. timber delivered at $15	360.00
24,000 ft. B. M. timber framed and erected at $7.50	180.00
400 lbs. iron at 25 cts	10.00
Total, $5.52 per lin. ft. bridge	$718.00
Pile Abutments:	
1,400 lin. ft. piles (40 piles, 35 ft.) delivered at 8 cts	$112.00
1,400 lin. ft. piles, driven, 12 cts.	168.00
1,700 lbs. iron,. 2.5 ct	42.50
7,600 ft. B. M. timber delivered, $15	114 00
7,600 ft. B. M. framed and erected, $7.50	57.00
Total for two abutments	$493.50
Howe Truss Bridge:	
29,000 lbs. cast iron at 2 cts	$ 580.00
34,000 lbs. wrt. iron, 2½ cts	850.00
71,700 ft. B. M. timber at $15	1.075.00
130 lin. ft. bridge framed and erected at $7.50	975 00
Total	$3.480.00
Train service	50.00
Total	$3.530.00
Summary:	
Falsework, materials	$ 437.20
Falsework labor (by contract)	280 80
Pile abuts., materials	268.50
Pile abuts., labor	225.00
Howe truss bridge, materials	2.515.00
Howe truss bridge, labor	975.00
Train service	50.00
Grand total, 130 lin. ft. at $36.50	4.751.50

It will be noted that there was no crib, crib filling or riprap protection for the abutments. It would not be excessive to add 400 cu. yds. of riprap and rock in cribs, at $1.50 per cu. yd., and 24,000 ft. B. M. (or 2,000 lin. ft.) of hewed timber for two cribs to protect the abutments. For the actual cost of building such cribs the reader is referred to Gillette's "Handbook of Cost Data," page 501. A common contract price in the west is 15 cts. per lin. ft. of crib timber in place.

The full cost of the timber for the falsework in this bridge is charged against the bridge, but, since most of it possesses a salvage value, not to exceed half the cost of the timber (half of $360) should be so charged.

It will be noted that the contract price of framing and erecting the bridge was $950, which is equivalent to about $14 per M ft. B. M. in the bridge, exclusive of the falsework. The falsework cost, $718, which, if added to the $975, gives a cost of $1,693, or $13 per lin. ft. of bridge.

The piles for the falsework were driven in bents about 11 ft. apart, two piles to the bent. While this is a sufficient support for the dead load of a Howe truss bridge, it is evidently insufficient to support any trainload during construction. In rebuilding an old bridge, without interruption to traffic, it is evident that the falsework would be much more expensive than in this case, which is typical of new construction rather than of reconstruction.

The following costs relate to a Howe truss bridge 120 ft. long, and the remarks concerning the 130-ft. bridge apply also to this one:

Falsework:	
540 lin. ft. piles (18 piles) delivered at 8 cts	$ 43.20
540 lin. ft. piles driven, 12 cts	64.80
28,000 ft. B. M. at $15	420.00
28,000 ft. B. M. framed and erected, $7.50	210.00
400 lbs. iron 2.5 ct	10.00
Total at $6.23 per lin. ft. bridge	$748.00
Pile Abutments:	
Same as for previous bridge	$ 493.50
Howe Truss Bridge:	
63,000 ft. B. M. at $15	$ 945.00
28,400 lbs. wrt. iron at 2.5 ct	710.00
25,400 lbs. cast iron at 2 cts	508.00
120 lin. ft. framed and erected, $7.50	900.00
Total	$3,063.00
Train service	50.00
Summary:	
Falsework, materials	$ 463.20
Falsework, labor (by contract)	274.80
Pile abutment, materials	268.50
Pile abutment, labor	225.00
Howe truss bridge, materials	2,163.00
Howe truss bridge, labor	900.00
Train service	50.00
Grand total at $36.20 per lin. ft.	$4.344 50

As previously stated, no protection cribs, rock filling, or riprap are included in the cost of the abutments.

In subsequent issues we shall give the cost of other Howe truss bridges, and finally we shall give data upon which to base accurate estimates of the cost of such bridges for all spans from 40 ft. up to 150 ft.

Method of Construction of the Water Power Plant on the Chicago Drainage Canal.

BY LE ROY K. SHERMAN.*

The hydro-electric development of 36,000 h. p. by the Sanitary District of Chicago near Lockport, Ill., is now nearing completion, as shown by the accompanying recent illustrations and before the end of the year electric power will be transmitted to the sub-stations at Chicago.

Excavations of tail-race and the construction of the walls and levees of the head-race were begun in October, 1903.

The power house, with tail-race excavation, is shown from the down-stream side in Fig. 1, and Fig. 2 shows the power house from up stream with the completed levee walls and fender wall of submerged arches, the latter designed to keep out floating ice from the forebay. This work was started in May, 1905. Fig. 3 is a view of one of the eight turbine chambers in the power house showing the six wheels in position on the horizontal shaft ready for the upper casing to be placed. This chamber will be full of water, which will pass through the wheels and discharge, under the main floor of building, through curved concrete draft tubes into the tail race.

Fig. 4 shows the interior of the power house with one of the 6000-kw alternating current generators directly connected to the turbine shaft, which shaft passes through a stuffing box in the bulkhead wall from the turbine chamber just referred to. The rotor of this generator is 17 ft. 6 ins. in diameter and revolves at 165 r. p. m. The generator was built by the Crocker-Wheeler Company. The single 12-in shaft carrying the generator and six 54-in. wheels required very precise alignment. The method finally adopted by the engineer was as follows: A fine steel piano wire was stretched parallel to the end bearings and the intermediate bearings lined up by horizontal offsets from this wire. For the vertical alignment a simple but extremely accurate water level was designed by the assistant engineer, E. J. Fucik. The device consisting of two vessels connected by rubber tubing and filled with water. The distance between the top of shaft and water surface was read over one bearing by means of a movable hook gauge. The hook gauge was then moved to the vessel of water over the bearing to be tested. If the shaft was level the gauge readings would be the same.

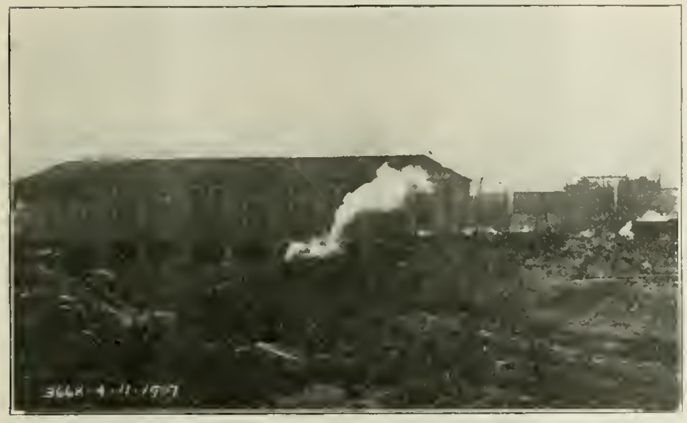


Fig 1—Power House From Down-Stream Side.

Much greater precision can be secured by these methods than can be obtained by transit and wye-level.

In conjunction with the power house there are two movable crested dams. Fig. 5 is a view of these dams under construction, the masonry wall at one side not yet built. It shows very clearly the features of the dam. A cylinder sector is hinged at the down stream end and capable of being revolved about this hinge into or above the water tight chamber of concrete. The operation is similar to the present bear-trap dam at Lockport. The crest is raised or lowered by admitting water into the dam chamber or removing this water into the tail-race. The surface of water, and hence the crest of dam, may be maintained at a constant elevation by what are known as weir tubes. The view shows the dam supported on shaft props in its highest position which would cut off the flow of water over the crest.

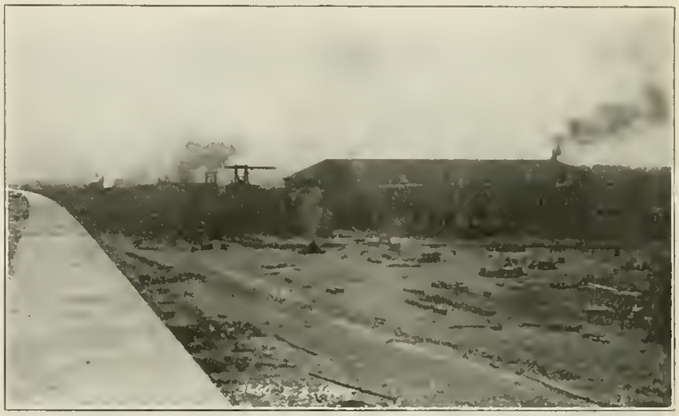


Fig. 2—Power House From Up-Stream Side.

Fig. 6 is a view of the dams from the down stream side. Mr. E. L. Cooley was designer of this structure.

The old Illinois and Michigan Canal will be abandoned between Chicago and Joliet on completion of the Drainage Channel. To provide a passage for such canal traffic, around the 34-ft. fall at the power house, the canal lock shown in Figs. 7 and 8 is being built. The former is a view in the lock, looking down stream and shows one of the immense tail-gates. The latter is looking up-stream and shows a pair of headgates. The lock is 22 ft. wide, 132 ft. long and has a normal lift of from 34 to 42 ft. It is the largest single lift in the world. The lock walls are 59 ft. high.

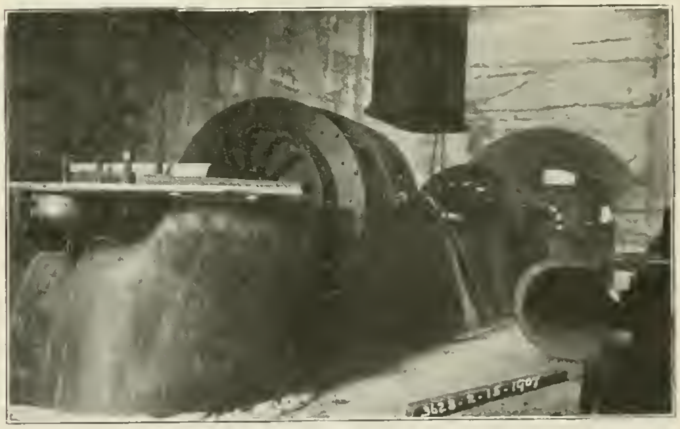


Fig. 3—Turbine Chamber.

All of the foundations for these works are limestone rock. No special difficulty was encountered except in excavating certain of the wheel pits of the power house, where large clay pockets occurred. In one instance the foundation piers are partially supported, over the clay, by an inverted arch. In several piers which spanned wide clay seams or which had but a slight foothold on the rock, 12-in. I-beams 16 ft. long were bedded in the concrete to reinforce against shear. The writer considers such reinforcement of heavy material superior to reinforcement by equivalent weight of numerous small rods for this class of foundation work. There were numerous springs of water issuing from the crevices of the rocks in the excavation pits and before concrete was deposited the springs were coralled and trained by A-shaped drains to the pump sump so that the concrete did not come in contact with running water. It is useless to attempt to plug up these springs and unless the smallest stream is taken care of, it will eat its way through the green concrete and come to the surface. Great care was taken to excavate and concrete clay pockets or seams near the upstream side of the foundations, which would be subject to unequal water pressure and which might cause a washout or a "short circuit" of water between head and tail race.

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*Resident Engineer, Sanitary District of Chicago, Joliet, Ill.

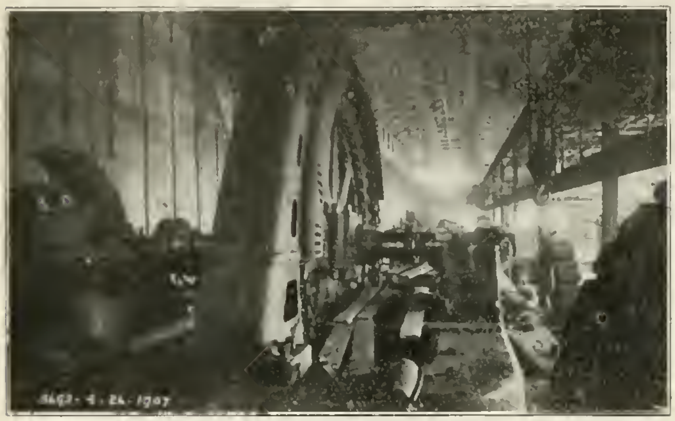

Fig. 4—Interior of Power House.

Concrete work was conducted simultaneously with excation, the rocks being crushed for concrete. Blasting was kept as a rule over 30 ft. from the concrete, and the charges regulated according to distance. An experiment was made on the transmission of the blow from blasting through solid rock. Six sticks of 60% dynamite fired on one side of a wall of rock, 15 ft. thick, caused a 15-oz. plumb bob suspended (on the opposite side and just touching the wall) by a 3-ft. string, to swing out 3 ins. The rock wall was separated from the rock in which the charge was fired by a 3-in. cut made by a channeling machine.

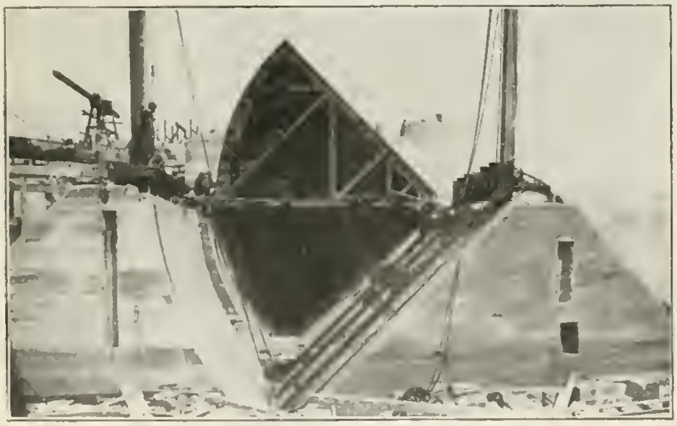

Fig. 5—View of Movable Crested Dam.

Plant and Operation.—The Hayes Bros. Company of Janesville, Wis., are contractors for the power house, lock and dams. Excavation of rock, from tail-pits of the power house and similar contracted areas was handled by a Carson-Lidgerwood cableway of 400 ft. span, which deposited the stone directly into an Austin rock crusher, or into dump cars on an elevated track, which led to the crusher. More open rock work was excavated, after blasting, by a small steam shovel and the loaded dump cars hauled by cable and hoisting engine, up an incline to a second crusher. The stone was crushed to 1½ in. maximum size and screened through a half-inch mesh. Tests of this screening for fineness showed in general, the following:

Percentage held on a No. 6 sieve	74.2
Passed No. 6 and held on a No. 50 sieve	12.3
Passed No. 50 and held on a No. 80 sieve	6.7
Passed No. 80	6.8
Total	100.0

Such material as passed a No. 6 seive was considered as "sand" for making concrete. Great difficulty was experienced in securing a sufficient amount of such fine material from the crusher, especially in wet or windy weather. Eventually the contractors were forced to bring in sand and fine screenings to supply the deficiency.

The concrete was mixed in the proportion of 1:2½:4½ or 1:3:6 according to the particular part of the structure. The mixture was made rather sloppy. External surfaces were made with spade finish and as good results secured in general as with mortar-faced work. All stages of concrete work were under constant supervision of the Sanitary District inspectors. The concrete plant consisted of three Page mixers of one cubic yard each and one half-yard Smith mixer. Concrete was generally conveyed to the work in dump cars pushed by men, although horses or hoisting engines were sometimes used. For elevated work the cars of concrete were hoisted in elevators by hoisting engines. Concrete in the fender wall was placed by bucket from a traveling gantry.

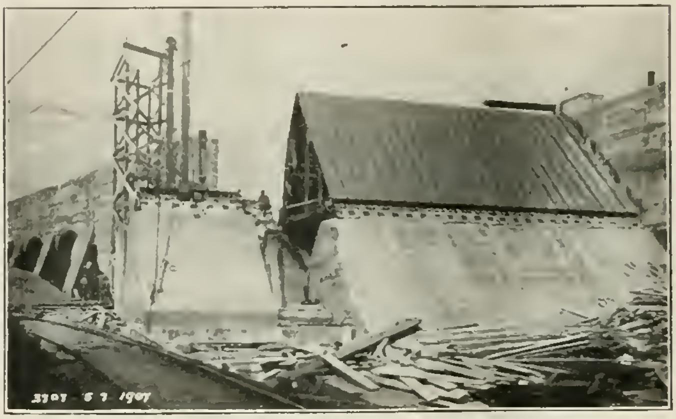

Fig. 6—View of Dams From Down-Stream.

The outer walls of the power house are made of concrete blocks. These blocks were made on the ground by the American Hydraulic Stone Company's process. The upper portion of the cornice is of reinforced concrete built in place. The roof of the building is to be covered with red Conosera tile.

The switchboards, bus bars and electrically operated switches for the 44,000-volt transmission line, are located on two balcony floors. Each of these floors contains 9,000 sq. ft. They are made of concrete arches of 10-ft. span between the lower flanges of 18 in. I-beams. The arches are elliptical in section, 5 ins. thick at crown and have a rise of 16 ins. The floors are reinforced with No. 10 3-in. mesh, expanded metal and have a granolithic surface. Bids for the concrete work of these floors were rejected as being too high. The work was done directly by the Sanitary District, under supervision of the writer, and cost $7,400.00.

The following table gives data for the power house and auxiliary hydraulic works:

Concrete in power house, cu. yds.	38,000
Concrete in lock, dams and fender wall, cu. yds.	32,000
Cost of power house complete, exclusive of machinery	$375,000
Cost of lock, dams and fender wall	318,000
Actual horse-power available at plant with flow of 600,000 cu. ft. per min	31,000

A SUBMARINE CABLE FROM BARCELONA to Palma de Mallorca, in the Balearic Islands, has just been laid. It is 117 miles long, the cable ship laying it in less than two days. The contract price for the cable laid was £30,000 ($145,995), which will be paid by the Spanish Government. This line has long been required for commercial purposes, and the Government yielded to the urgent demand of the united business elements of Barcelona and Palma de Ballorca. Barcelona is the great commercial metropolis of Spain, with a population of about 700,000, and Palma de Mallorca is the principal city of the Balearic Islands, with a population of about 70,000, and is the seat of considerable industry. Heretofore the only cable line connecting the Balearic Islands and the Spanish Peninsula was the one from Valencia to Palma, but this was not sufficient for the commercial necessities of Barcelona.

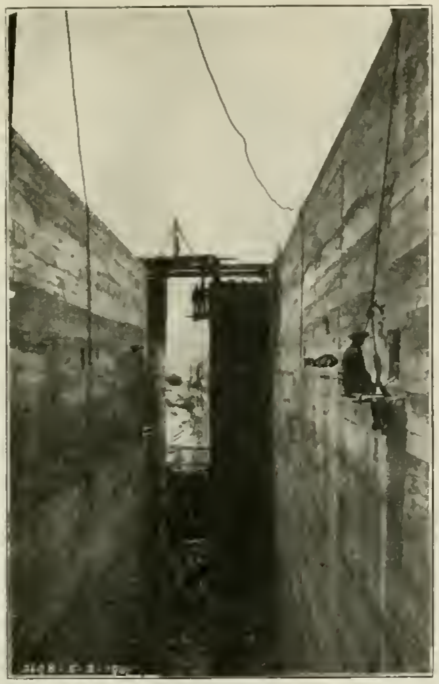

Fig. 7—Interior View of Lock Showing Tail-Gate.

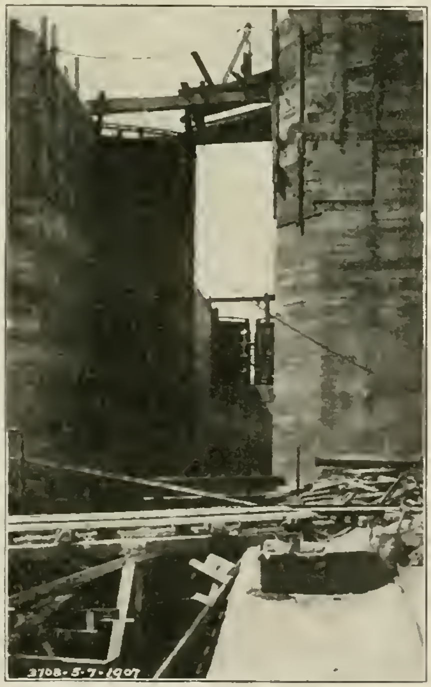

Fig. 8—Interior View of Lock Showing Pair of Head-Gates.

Engineers' Pocketbook of Reinforced Concrete.*

BY E. LEE HEIDENREICH, C. E., M. E.

(Continued from Engineering World, May 24, 1907.)

Structural steel or cast iron columns are frequently employed in reinforced concrete structures on account of rapidity in erection after they have been delivered on the premises. If structural steel columns, owing to their smaller floor area, are employed, Fig. 1 gives a typical view of the attachment of girder and floor beams, and Fig. 2 shows a view of the base for same. Fig. 3 indicates the reinforcing of a heavy steel floor girder and a method of running the slab beams in to same.‡

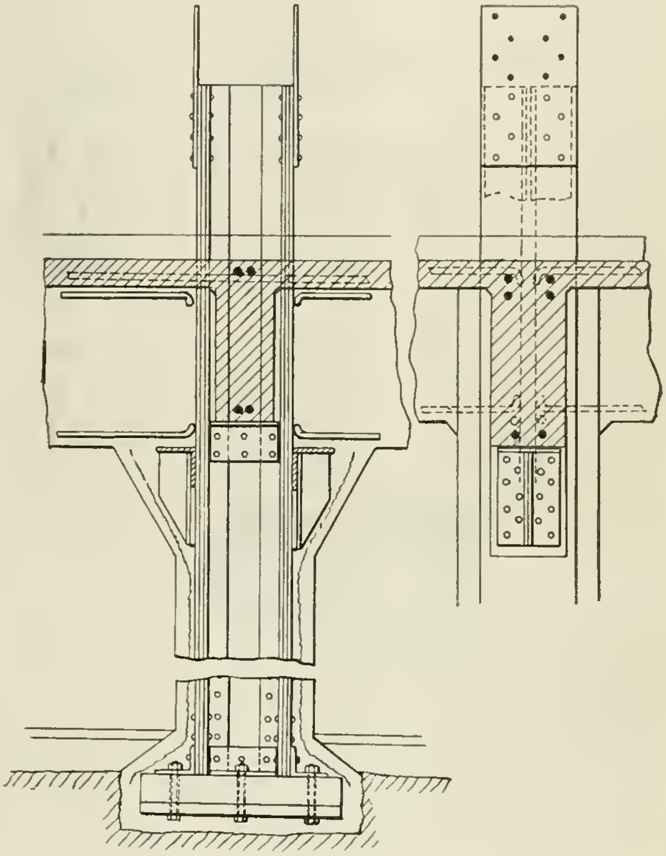

Fig. 1—Steel Core Column Footing and Bracket for Beam and Girder Reinforcement.

The steel columns are proportioned for working stresses of 16,000 lbs. per sq. in., the hollow columns being filled with concrete (Fig. 4). The cast iron columns in this building are generally 12 ins. in diameter down to the fourth floor and 15 ins. to the second floor with thicknesses varying from

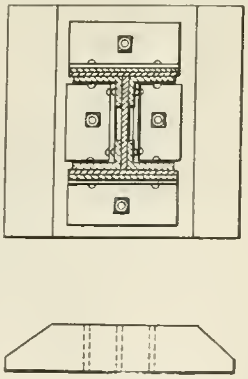

Fig. 2—Plan and Side Elevation of Cast Iron Base for Steel Cores.

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†143 Liberty St., New York.

‡This construction was used in the Eagle Warehouse & Storage Company's Building on Fulton St., Brooklyn, N. Y.

1¼ ins. to 1¾ ins. and lengths of from 12 ft. 6 ins. to 13 ft. They are of standard construction. Fig. 5 shows flange connections faced and drilled for ¾ in. connection bolts. The upper ends of the columns are special in that, above the beams and girder seats, they are made square outside with rectangular openings 5 or 6 ins. wide and 14 ins. deep in the face, to permit the reinforcement rods in beams and girders to pass through for purposes of continuity. The fireproofing concrete is extended 2 inches beyond the flanges and is carefully finished with beveled fillets. The brick walls are carried at every story by reinforced concrete girders (Fig. 6) with their outer faces 4½ ins. clear of the outer face of the brick work. The concrete walls are 12 ins. thick for the first three stories, 10 ins. for the next two, 9 ins. for the next two and 8 ins. for the upper story, reinforced with ½ in. rods 2½ ft. on centers running horizontally and ½ in. rods 3 ft. on centers running vertically.

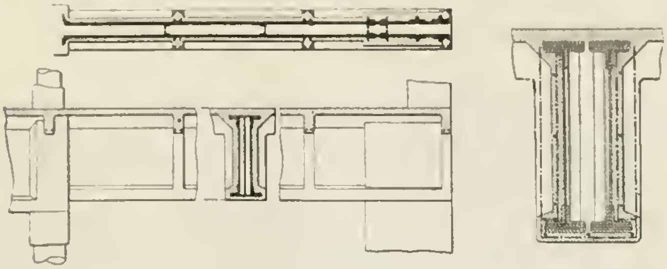

Fig. 3—Fireproofing of Box Girder and Twin Girder.

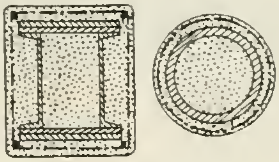

Fig. 4—Fireproofing and Filling for Columns.

The author invariably uses a wire fabric for walls, running same through the reinforced concrete columns and connecting with floor and ceiling, both to prevent temperature cracks and to guard against cracks resulting from uneven settling of building foundation.

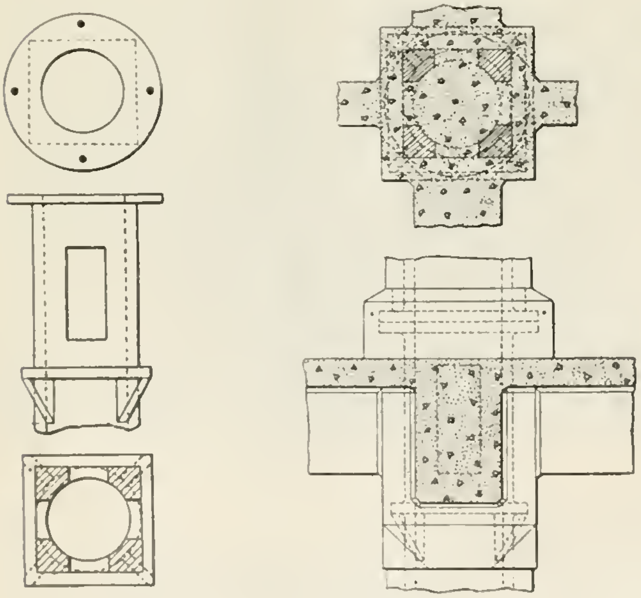

Fig. 5.—Special Top for Cast Iron Column; Column and Girder Connections.

The author also has advocated a construction in which the structural steel, correctly located, should be calculated to assume the dead loads of the building as well as the loads incidental to the building erection and wind pressure,—and afterwards incased in concrete in a manner to support the additional live load. Such a building could be erected with the rapidity inherent in the traditional skyscraper and several floors put in simultaneously without waiting for the setting of the column concrete from floor to floor. This construction has been adopted by several well known engineers and as an example the construction referred to in Engineering News, Vol. 57, No. 17, is here illustrated.*

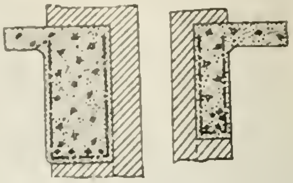

Fig. 6—Concrete Girders Supporting Brick Walls.

Fig. 7 shows details of the general construction. The original beams and girders consist of small I-beams usually from 4 to 5 ins. deep, entering into the columns and connected to them by bent plates and angles. The column itself consists of four angles latticed together, so designed as to form when filled with concrete a hooped reinforcement with a maximum radius of gyration. The column details of course may be changed. In such construction it hardly needs to be added that the support of molds and scaffolding is simply a matter of hooks, no floor supports being required.

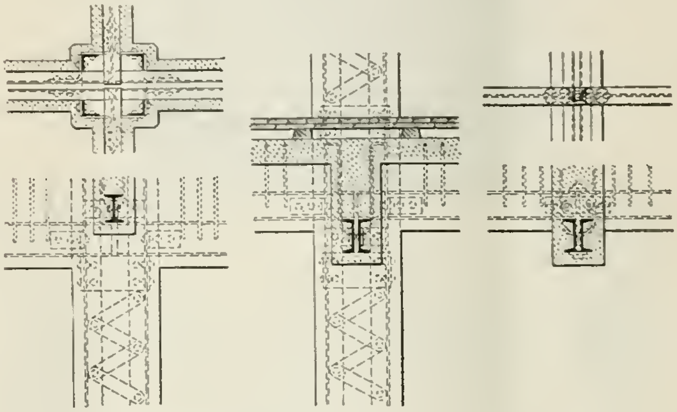

Fig. 7—General Structural Details.

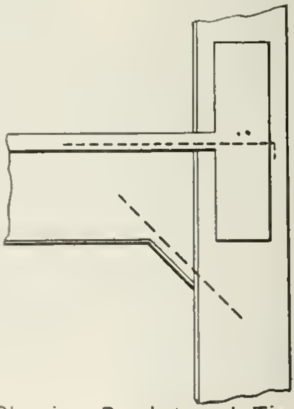

Fig. 8—Section Showing Bracket and Ties in Beams and Girders at Walls.

Fig. 8 shows a typical wall beam and its connection to a girder and bracket to the column. The wall beams usually represent the entire panel between the lintel of one floor opening and the sill of the opening on floor above.

(To be continued.)

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*Mr. Guy B. Waite, New York city.

CONTRACT NEWS

We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Bids Open.		See Issue
July 3.	Huntington, Ind.	June 26
July 3.	Huntington, Ind.	June 26
July 3.	Richmond, Ind.	June 26
July 3.	Peru, Ind.	June 26
July 5.	Harrisburg, Pa.	June 12
July 6.	Laporte, Ind.	June 26
July 6.	Enterprise, O.	June 26
July 6.	Logan, O.	June 19
July 8.	Rathdrum, Idaho	June 19
July 8.	Roswell, N. Mex.	June 12
July 8.	Fredericton, N. B.	June 12
July 8.	Danville, Ind.	July 3
July 8.	Evansville, Ind.	July 3
July 8.	Pittsburg, Pa.	July 3
July 9.	Milwaukee, Wis.	July 3
July 9.	Fargo, N. Dak.	July 3
July 9.	Massillon, O.	June 26
July 9.	Beatrice, Neb.	June 26
July 10.	Toledo, O.	June 19
July 10.	Nashville, Tenn.	June 12
July 11.	Washington, D. C.	June 26
July 12.	Indianapolis, Ind.	June 26
July 12.	Cincinnati, O.	June 19
July 12.	Wapakoneta, O.	July 3
July 13.	Cleveland, O.	June 19
July 15.	New Orleans, La.	June 12
July 15.	Athens, Ga.	July 3
July 15.	San Jose, Cal.	July 3
July 15.	Mt. Pulaski, Ill.	July 3
July 15.	Dillon, Mont.	July 3
July 15.	Barnstable, Mass.	July 3
July 15.	Jefferson, O.	July 3
July 16.	Newcastle, Ind.	July 3
July 16.	Toronto, Ont.	June 19
July 16.	Sandusky, O.	June 26
July 17.	Sandusky, O.	July 3
July 19.	Fort Snelling, Minn.	June 19
July 20.	Culpeper, Va.	June 26
July 20.	San Juan, Porto Rico	June 12
July 23.	Columbia City, Ind.	July 3
July 27.	Cleveland, O.	July 3
July 29.	Chardon, O.	July 3

Buildings.

Bids Open.		See Issue
July 3.	Baltimore, Md.	June 19
July 3.	Baltimore, Md.	June 26
July 4.	Norristown, Pa.	July 3
July 5.	Dunkerton, Ia.	June 26
July 5.	Spring Hill, Ia.	June 26
July 5.	Kalamazoo, Mich.	June 26
July 5.	Jersey City, N. J.	June 26
July 6.	San Marcos, Tex.	July 3
July 6.	Galesburg, N. Dak.	June 25
July 6.	Washington, D. C.	June 26
July 6.	Fort Jennings, O.	June 26
July 6.	Newark, N. J.	June 12
July 8.	Cincinnati, O.	June 12
July 8.	Fort Snelling, Minn.	June 19
July 8.	Los Angeles, Cal.	June 19
July 8.	Washington, D. C.	June 26
July 8.	New York, N. Y.	July 3
July 8.	Brooklyn, N. Y.	July 3
July 8.	Upper Sandusky, O.	July 3
July 8.	Aberdeen, S. Dak.	July 3
July 8.	Canton, N. Y.	July 3
July 9.	Hoboken, N. J.	July 3
July 9.	Burlington, Ia.	July 3
July 9.	Chicago, Ill.	July 3
July 9.	Indianapolis, Ind.	July 3
July 9.	Kansas City, Mo.	June 26
July 9.	Colorado Springs, Colo.	June 12
July 10.	Springfield, O.	June 19
July 10.	Knoxville, Tenn.	June 19
July 10.	New York, N. Y.	July 3
July 10.	Wichita, Kan.	July 3
July 10.	Washington, D. C.	July 3
July 11.	Philadelphia, Pa.	July 3
July 11.	Vineland, N. J.	July 3
July 11.	Chicago, Ill.	June 26
July 12.	Sandusky, O.	June 26
July 12.	Greensburg, Ind.	July 3
July 12.	Syracuse, Ind.	July 3
July 15.	Petersburg, Ind.	July 3
July 15.	Tuscumbia, Ala.	July 3
July 15.	Paris, Tex.	July 3
July 15.	Fort Slocum, N. Y.	July 3
July 15.	Wilkes-Barre, Pa.	June 26
July 15.	Paris, Tex.	June 26
July 15.	Cleveland, O.	June 26
July 15.	Nelson, B. C.	June 26
July 15.	Sheboygan, Wis.	June 19
July 16.	Newark, N. J.	June 19
July 16.	Washington, D. C.	July 3
July 17.	St. Joseph, Mo.	June 26
July 18.	Washington, D. C.	June 26
July 18.	Chattanooga, Tenn.	June 26
July 18.	Williamsport, Ind.	June 12
July 18.	Baxley, Ga.	July 3
July 18.	Wilkesbarre, Pa.	July 3
July 18.	Wapakoneta, O.	July 3
July 18.	Neah Bay, Wash.	July 3
July 19.	Gainesville, Fla.	June 19
July 19.	Gainesville, Fla.	June 26
July 19.	Athens, O.	June 26
July 19.	Fort Leavenworth, Kan.	July 3
July 20.	Minneapolis, Minn.	July 3
July 20.	Fresno, Cal.	July 3
July 20.	Jacksonville, Fla.	July 3
July 22.	East Orange, N. J.	July 3
July 22.	Casper, Wyo.	June 26
July 23.	Cheyenne, Wyo.	July 3
July 24.	Fort Sam Houston, Tex.	July 3
July 24.	Aurora, Ill.	June 26
July 31.	Owosso, Mich.	July 3
Aug. 5.	Crookston, Minn.	July 3
Aug. 9.	Monticello, Ind.	July 3
Aug. 12.	Mason City, Ia.	July 3

Roads and Streets.

Bids Open.		See Issue
July 3.	Appleton, Wis.	June 19
July 3.	Des Moines, Ia.	June 19
July 3.	Mansfield, O.	June 12
July 3.	Portland, Ore.	June 26
July 3.	Paoli, Ind.	June 26
July 3.	St. Paul, Minn.	June 26
July 4.	Emporia, Va.	June 26
July 4.	Johnson City, Tenn.	June 19
July 5.	Cincinnati, O.	June 12
July 5.	New York, N. Y.	June 26
July 5.	Brazil, Ind.	June 26
July 5.	Lancaster, O.	June 25
July 5.	Concord, N. H.	July 3
July 5.	Morton Park, Ill.	July 3
July 5.	Iowa City, Ia.	July 3
July 5.	Hillsboro, Ill.	July 3
July 5.	Grand Rapids, Mich.	July 3
July 5.	Versailles, Ind.	July 3
July 6.	Pine Bluffs, Ark.	June 26
July 6.	Newport, Ind.	June 26
July 6.	Wapakoneta, O.	June 26
July 6.	Wooster, O.	June 26
July 6.	Newport, Ind.	June 19
July 6.	Evansville, Ind.	July 3
July 8.	Syracuse, N. Y.	July 3
July 8.	Kansas City, Mo.	July 3
July 8.	Salem, N. J.	July 3
July 8.	Pleasant Ridge, O.	July 3
July 8.	Harrisburg, Pa.	July 3
July 8.	Clarion, Pa.	June 19
July 8.	La Porte, Ind.	June 26
July 8.	Cape May, N. J.	June 26
July 9.	Cambridge, O.	June 26
July 9.	Steubenville, O.	June 26
July 9.	Dayton, O.	July 3
July 9.	Newark, N. J.	July 3
July 9.	McLeansboro, Ill.	July 3
July 9.	Wilmington, Del.	July 3
July 9.	Des Moines, Ia.	July 3
July 9.	Vincennes, Ind.	July 3
July 9.	Milwaukee, Wis.	July 3
July 10.	St. Bernard, O.	July 3
July 10.	Indianapolis, Ind.	July 3
July 10.	Albany, N. Y.	July 3
July 10.	Brooklyn, N. Y.	July 3
July 10.	Cincinnati, O.	July 3
July 10.	Baltimore, Md.	July 3
July 10.	St. Clairsville, O.	June 26
July 10.	Atlantic City, N. J.	June 26
July 11.	Sullivan, Ind.	June 26
July 11.	Chicago, Ill.	July 3
July 12.	Indianapolis, Ind.	July 3
July 12.	St. Louis, Mo.	July 3
July 12.	Hudson, Mich.	July 3
July 12.	Cincinnati, O.	June 26
July 13.	Cleveland, O.	June 19
July 13.	Balls Bluff, Va.	June 19
July 15.	Cincinnati, O.	July 3
July 15.	Sedalia, Mo.	July 3
July 15.	Green Bay, Wis.	July 3
July 16.	Newcastle, Ind.	July 3
July 16.	Chardon, O.	July 3
July 16.	Cleveland Heights, O.	June 19
July 19.	Cincinnati, O.	July 3
July 19.	Columbus Barracks, O.	July 3
July 19.	Bluffton, Ind.	July 3
July 19.	Fort Leavenworth, Kan.	July 3
July 20.	Oshkosh, Wis.	July 3
July 20.	Findlay, O.	July 3
July 20.	Greencastle, Ind.	June 26
July 20.	Crawfordsville, Ind.	June 25
July 20.	Findlay, O.	June 26
July 23.	Painesville, O.	July 3
July 27.	Cleveland, O.	July 3
Aug. 1.	Greencastle, Ind.	July 3

Sewers.

Bids Open.		See Issue
July 3.	New York, N. Y.	June 26
July 3.	Harrisburg, Pa.	June 26
July 3.	Des Moines, Ia.	June 26
July 4.	Johnson City, Tenn.	June 19
July 4.	Ensley, Ala.	July 3
July 5.	Salt Lake City, Utah	July 3
July 5.	Dubuque, Ia.	July 3
July 5.	Harrisburg, Pa.	June 12
July 8.	Elbow Lake, Minn.	June 19
July 8.	Hastings, Minn.	June 26
July 8.	Washington, D. C.	June 26
July 8.	Independence, Ia.	June 19
July 8.	Napoleon, O.	June 19
July 8.	Youngstown, O.	July 3
July 8.	St. Paul, Minn.	July 3
July 8.	Harlan, Ia.	July 3
July 9.	Crookston, Minn.	July 3
July 10.	Buffalo, N. Y.	July 3
July 11.	Chicago, Ill.	July 3
July 13.	Norwood, O.	July 3
July 15.	Steubenville, O.	July 3
July 15.	Brookings, S. Dak.	June 25
July 16.	Torrington, Conn.	July 3
July 16.	Cleveland Heights, O.	June 19
July 20.	Pensacola, Fla.	June 26
July 22.	Willoughby, O.	June 19
July 22.	San Jose, Cal	July 3
July 25.	Frankfort, Ind.	June 19
July 25.	Frankfort, Ind.	June 26
Aug. 6.	Alexandria, La.	July 3

Water Supply.

Bids Open.		See Issue
July 3.	New York, N. Y.	June 26
July 3.	Brooklyn, N. Y.	June 26
July 5.	Owosso, Mich.	June 19
July 6.	Lena, Ill.	July 3
July 6.	Cincinnati, O.	July 3
July 7.	Grand Island, Neb.	June 26
July 8.	Pawhuska, Okla.	June 26
July 8.	Hastings, Minn.	June 26
July 8.	East Hamburg, N. Y.	July 3
July 8.	Philadelphia, Pa.	July 3
July 9.	Glencoe, Ill.	July 3
July 9.	Jackson, Mo.	June 26
July 9.	Jackson, Mo.	June 12
July 10.	Columbus, O.	June 26
July 10.	Joliet, Ill.	July 3
July 11.	New York, N. Y.	July 3
July 11.	Chicago, Ill.	July 3
July 12.	Bloomer, Wis.	July 3
July 12.	Indianapolis, Ind.	June 26
July 15.	North Milwaukee, Wis.	June 25

July 16 Sayre, Okla. ....June 26
Aug. 19. Sacramento, Cal. .... ..June 5
July 20. St Paul, Minn. ... ..July 3
July 22. Omaha, Neb. ....July 3
July 31. North Battleford, Sask. ..July 3
Sept. 4 New Orleans, La. ... .July 3

Miscellaneous.

July 3. New York, N. Y., Skylight, Etc., June 26
July 3. Tacoma, Wash., Power Plant, June 26
July 3. Detroit, Mich., Hire of Dredging Plant, June 5
July 5 National Military Home, Kan., Renewing Steam Pipes, July 3
July 6. New Orleans, La., Sill, Mattresses, June 19
July 8. Chicago, Ill., Derricks, July 3
July 9. Brooklyn, N. Y., Ash Disposal, July 3
July 10. Oakland, Cal., Street Sweeping, July 3
July 10. New York, N. Y., Breakwater Extension, June 12
July 10. Chicago, Ill., Foundation Work, June 26
July 10. Crystal Falls, Mich., Power Station Addition, June 26
July 11. New York, N. Y., Planting Trees, Etc., July 3
July 12. Fort Morgan, Ala., Sea Wall, June 19
July 15. Petit Roches, N. B., Breakwater Extension, July 3
July 15. Fort St. Philip, La., Sheet Pile Sea Wall, June 19
July 16. West Point, N. Y., Steam Piping, July 3
July 16. Newport, R. I., Garbage Plant, July 3
July 17. Fort Myer, Va., Garbage Crematory, June 26
July 18. Brooklyn, N. Y., Riprap Sea Wall, July 3
July 18. Albany, N. Y., Aqueduct, June 26
July 18. Cincinnati, O., Concrete Dam, June 26
July 22. Fort D. A. Russell, Wyo., Garbage Crematory, July 3
July 23. Fort Morgan, Ala., Wharf Repairs, Etc., July 3
July 26. Holland, Mich., Pier Repairs, July 3
June 26. Winnetka, Ill., Pile Pier, June 26
July 27. Boston, Mass., Concrete Floor, July 3
July 30. New York, N. Y., Retaining Wall, July 3
Aug. 1. Washington, D. C., Torpedo Boats, June 5
Aug. 3. San Juan, R. I., Pier Repairs, June 26
Aug. 5. Harrisburg, Pa., Garbage Disposal, June 26
Aug. 20. San Diego, Cal., Wharf and Trestle, June 26
Sept. 3. Winnipeg, Man., Hydro-Electric Development, June 19

Excavation, Earth and Rock.

—— Minneapolis, Minn., Railroad Grading, July 3
July 3. Detroit, Mich., Dredging, June 12
July 5. Memphis, Tenn., Levee Work, June 12
July 5. Sandusky, O., Rock Removal, June 12
July 5. Cleveland, O., Dredging, June 12
July 6. New Bedford, Mass., Dredging, June 12
July 6. Martinsville, Ind., Ditch Work, July 3
July 6. Rochester, Ind., Ditch Work, July 3
July 8. Boone, Ia., Tile Drain, June 26
July 10. New Orleans, La., Levee Work, June 26
July 10. Estherville, Ia., Levee Work, June 26
July 10. New York, N. Y., Dredging, June 12
July 10. Jerseyville, Ill., Excavation, Filling, Etc., June 19
July 10. Pensacola, Fla., Railroad Grading, July 3
July 10. Des Moines, Ia., River Improvement, July 3
July 10. Baltimore, Md., Test Well, July 3
July 12. Albany, N. Y., Excavation, June 26
July 13. Collinston, La., Excavation, June 19
July 15. Urbana, O., Excavation, June 19
July 17. New York, N. Y., Dredging, June 19
July 17. Newport, R. I., Dredging, June 19
July 17. Block Island, R. I., Dredging, June 26
July 18. Grand Rapids, Mich., Rock Excavation, Etc., July 3
July 20. Charleston, S. C., Dredging, June 26
July 20. Portsmouth, N. H., Ledge Removal, June 26
July 20. Charleston, S. C., Dredging, July 3
July 24. Jacksonville, Fla., Dredging, June 26
Aug. 24. New York, N. Y., Dredging, July 3
July 24. New York, N. Y., Dredging, July 3
July 24. Carroll, Ia., Ditch Work, July 3
July 27. Woodbridge, N. J., Dredging, July 3
June 29. York, Ill., Ditch Work, June 26
July 29. Skagway, Alaska, Dredging, Etc., June 19
July 30. Newark, N. J., Dredging, July 3
Aug. 1. Emmetsburg, Ia., Drainage Work, July 3
Aug. 1. Nevada, Ia., Ditch Work, July 3
Aug. 7. San Juan, P. R., Dredging, July 3

Materials, Machines, Supplies, Tools Etc

July 3. Washington, D. C., Sanitary Fixtures, Pipe, Etc., June 26
July 3. Brooklyn, N. Y., Motor Lawn Mowers, June 26
July 3. Brooklyn, N. Y., Gravel, Broken Stone, June 26
July 3. Brooklyn, N. Y., Hydrants, Water Pipe, June 26
July 6. Rushville, Ind., Gravel, June 26
July 8. Los Angeles, Cal., Engine Generator Set, June 19
July 8. Philadelphia, Pa., Pipe, Feed Water Heaters, Etc., July 3
July 8. Lebanon, Ill., Engine, July 3
July 8. Washington, D. C., Dynamite, Blasting Material, Etc., July 3
July 9. Bloomington, Ill., Electrical Equipment, July 3
July 9. Fort Wayne, Ind., Water Pipe, July 3
July 9. St. Louis, Mo., Flagstaffs, June 19
July 9. New York, N. Y., Boilers, Laundry Machinery, June 26
July 10. Columbus, O., Pumping Machinery, June 26
July 10. Chicago, Ill., Boiler Feed Pumps, July 3
July 11. Charleston, S. C., Lumber, Rubble Stone, July 3
July 12. St. Paul, Minn., Electric Elevator, July 3
July 12. Kansas City, Mo., Fire Hydrants, July 3
July 13. Georgetown, O., Electric Equipment, June 19
July 16. Washington, D. C., Portable Track, Cement, Etc., July 3
July 16. Washington, D. C., Drafting Materials, July 3
July 16. Washington, D. C., Steam Shovels, Plows, Etc., July 3
July 20. Puget Sound, Wash., Traveling Cranes, June 26
July 23. Hoboken, N. J., Fire Engines, July 3
July 23. Mare Island, Cal., Cement, Pipe, Etc., July
July 30. San Francisco, Cal., Boilers, July 3
July 25. Omaha, Neb., Electric Elevator, July 3

BIDS ASKED.

Bridges.

Items Arranged Alphabetically by States.

San Jose, Cal.—Bids are asked by County Supervisors, Henry A. Pfister, Clerk, until July 15, for the following bridge work: Construction of a concrete bridge over Calabasas Creek on the Saratoga and Mountain View road; construction of a concrete bridge on the Springer road; extension of the southwest abutment of bridge over Adobe Creek.

Mt. Pulaski, Ill.—Bids are asked by Commissioners Lake Fork Special Drainage District, W. E. Birks, Chairman, until 1 p. m., July 15, for the construction of five steel bridges to be erected over the Drainage District of said District, three of said bridges being 60 ft. long and two 80 ft. long, all being 12 ft. wide.

Danville, Ind.—Bids are asked by Commissioners of Hendricks County, at Danville, until 10 a. m., July 8, for the construction of four bridges and repairing of two bridges. David D. Mills, County Auditor.

Columbia City, Ind.—Bids are asked by Commissioners of Whitley County, until July 23, for furnishing all material and labor for the construction of steel and concrete bridges, concrete abutments and concrete arches in the town of Collamer.

Evansville, Ind.—Bids are asked by Commissioners of Vanderbough County, until 10 a. m., July 8, for furnishing, erecting and completing four concrete bridges, also two abutments for Bayou bridge, according to the plans and specifications now on file with Harry Stinson, County Auditor.

Dillon, Mont.—Bids are reported asked by Commissioners of Beaverhead County, until July 15, for constructing two spans, 80 ft. each, at Big Hole River Crossing, near Willis Post Office.

Fargo, N. Dak.—Bids are asked by the Auditor of Cass County, until July 9, for the construction of a bridge 30 ft. long in Stanley Township and a bridge of the same length in Buffalo Township.

Chardon, O.—Bids are asked by Boards of County Commissioners of Geauga and Cuyahoga Counties, Court House, Chardon, until 11 a. m., July 29, for furnishing the material and labor necessary for the construction and repair of bridges at stations 4+0, 34+0, 40+65, 46+72, and the abutments at the iron bridge, on the Bainbridge Road, between the south corporation line of Chagrin Falls Village and the south Cuyahoga County Line.

Cleveland, O.—Bids are asked by County Commissioners, until 11 a. m., July 27, for the construction of bridge work per report No. 1593, concrete steel culvert, Chagrin Falls Township, in accordance with the form of contract and specifications to be furnished by A. B. Lea, County Surveyor, Court House, West 3rd St., Cleveland, O.

Sandusky, O.—Bids are asked by Commissioners of Erie County, Charles Kubach, Auditor, until 1:30 p. m., July 17, for labor and materials for erection of bridge, substructure and superstructure over Mills Creek on Monroe St., Sandusky.

Wapakoneta, O.—Bids are asked by County Commissioners, W. H. Meyer, County Auditor, until 11 a. m., July 12, for constructing two bridges across Auglaize River, one in Duchouquet Township and other in Logan township.

Pittsburg, Pa.—Bids are asked by Department Public Works, care City Controller, until 10 a. m., July 8, for repairing piers of bridge crossing the Monongahela River on the line of South 22d St.; also for repairing sidewalks on south approach to bridge crossing the Monongahela River on the line of Smithfield St.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., July 9, for constructing a stationary concrete bridge with concrete abutments, and all appurtenances thereto, across the Kinnickinnic River, at the intersection of 3d Ave. Certified check for $1,000 required with bid.

Buildings,

Items Arranged Alphabetically by States.

Tuscumbia, Ala.—Bids are asked by Judge O. G. Simpson, Judge of Probate, until noon, July 15, for the erection of a new county jail. Plans and specifications can be seen at the office of O. G. Simpson, Judge of Probate, at Tuscumbia, Ala., and at the office of E. J. Ostling, architect, Montgomery, Ala. Each bid must be accompanied by certified check for $500.

Washington, D. C.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 16, for constructing additions to the naval hospital, foot of 24th St., N. W., Washington, D. C., symmetrical with the northeast pavilion solarium, and connecting corridor. Wood, Donn & Deming, 808 17th St., N. W., Washington, D. C., are the architects.

Fresno, Cal.—Bids are asked by County Supervisors, W. O. Miles, Clerk, until 10 a. m., July 20, for building two cottages for isolating patients.

Washington, D. C.—Bids are asked by Elliott Woods, Superintendent, U. S. Capitol Building and Grounds, Washington, D. C., until noon, July 10, for furnishing interior wood doors and jamb casings for the office building, House of Representatives, Washington.

Jacksonville, Fla.—Bids are asked by Building Commissioner, Masonic Fraternity, George L. Drew, Secretary, until noon, July 20, for furnishing of materials and performing the labor required for building the new Masonic temple and office building, at Jacksonville, Fla., according to the plans and specifications which have been prepared by L. M. Weathers Co., Memphis, Tenn. Blank forms of bids, specifications and blueprints on file at the office of the Secretary of the Commission, Geo. L. Drew, No. 106 Main St., Jacksonville, Fla., and at the office of the architects at Memphis, Tenn.

Baxley, Ga.—Bids are asked by County Commissioners, until July 18, for a Court House at Baxley, Ga. Certified check for $5,000 is required with bid and Surety Company Bond of $100,000 to insure completion of contract. H. L. Lewman, Louisville, Ky., is architect.

Chicago, Ill.—Bids are asked by Department Public Works, John J. Hanberg, Commissioner, until 11 a. m., July 9, for labor and material for constructing two-story and basement brick and stone fire engine house at No. 11938-42 S. Peoria St., West Pullman, Chicago, Illinois, according to plans and specifications on file in the office of the Department of Public Works, Room 322, City Hall.

Greensburg, Ind.—Bids are asked by Ira A. Check, Trustee of Saltcreek Township, Decatur County, at Greensburg, until 10 a. m., July 12, for the construction of a school house to be finished by Sept. 6.

Indianapolis, Ind.—Bids are asked by John E. Cleland, Business Director of Indianapolis School Board, until July 9, for excavations, additions and repairs to school buildings Nos. 19, 25 and 41.

Monticello, Ind.—Bids are asked by the Commissioners of White County until Aug. 9 for the construction of of a new poor asylum. All previous bids have been rejected, the lowest being $31,750.

Petersburg, Ind.—Bids are asked by Advisory Board of Marion Township, Pike County, at Petersburg, until 10 a. m., July 15, for the construction of a school house to be completed by Sept. 15. Plans at office of Garfield Chambers, Trustee of Marion Township, Pike County.

Syracuse, Ind.—Bids are asked by School Trustees of Syracuse, Ind., until 8 p. m., July 12, for the heating and ventilating of new school buildings. H. W. Buchholzis, Secretary.

Burlington, Ia.—Bids will be received at the office of H. I. Goddard, architect, until 4 p. m., July 9, for construction of superstructure of 4-store, fire-proof business building.

Mason City, Ia.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Aug. 12, for the construction (including plumbing, gas-piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Mason City.

Fort Leavenworth, Kan.—Bids are asked by Capt. J. E. Normoyle, Constructing Q. M., until 11 a. m., July 19, for constructing the following buildings: One wagon shed and one stable and plumbing, electric wiring and lighting fixtures in stable, at Fort Leavenworth, Kan.

Wichita, Kan.—Bids are asked until noon, July 10, for the construction of the new First Baptist Church building in Wichita. Plans, etc., at the office of Frank Nighswonger, Turner Bldg., Wichita.

Owosso, Mich.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., July 31, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Owosso.

Crookston, Minn.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Aug. 5, for the construction (complete) of the U. S. Post Office building at Crookston, Minn.

Minneapolis, Minn.—Bids for the following work upon the site and building for the Pro-Cathedral of Minneapolis, Hennepin ave. and 16th and 17th Sts., Minneapolis, will be received until 1 p. m., July 20, at the office of the architect, E. L. Masqueray, office No. 312, Dispatch Bldg., St. Paul Minn.: (1) Grading. (2) Excavation. (3) Concrete foundations. (4) Granite ashlar, crypt story. (5) Masonry work, crypt story. The entire work embraced will be let in one contract. Contractors desiring to submit proposals must make application to the architect, in writing, on or by noon, July 3.

East Orange, N. J.—Bids are asked by Board of Education, Warren A. Clapp, Secretary, until 4 p. m., July 22, for the erection and completion of the Lincoln School, to be built on a site at the northeast corner of Central and Maple Aves., in the city of East Orange.

Hoboken, N. J.—Bids are asked by Board of Fire Commissioners, D. A. Haggerty, Clerk, until 8 p. m., July 9, for all work to be done and materials furnished in constructing a low pressure steam heating apparatus in Engine House No. 2.

Vineland, N. J.—Bids will be received at office of Commissioner of Charities and Corrections, State House, Trenton, N. J., until noon, July 11, for all the labor and material necessary for the complete erection of a heating plant at the Home for Soldiers, Sailors, Marines and their Wives and Widows, Vineland, N. J. Specifications with the Commissioner at Trenton.

Brooklyn, N. Y.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 5th St., New York, until 11 a. m., July 8, for the general construction, etc., of new public school 157, on Taaffe Pl. and Kent Ave., about 247 ft. south of Park Ave., Borough of Brooklyn. Security required is $200,000. Bids are also asked for installing heating and ventilating apparatus in public school 94, on westerly side of Sixth Ave., between 50th and 51st Sts., Borought of Brooklyn. Security required is $20,000. Bids are likewise asked for alterations, repairs, etc., to public schools 16, 34, 51, 55, 57, 90, Borough of Brooklyn.

Fort Slocum, P. O., New Rochelle, N. Y.—Bids are asked by Capt. F. C. Jewell, Q. M., until 11:15 a. m., July 15, for construction, plumbing, steam heating and electric wiring) of the U. S. Post Office at Owosso.

Canton, N. Y.—Bids are asked by George S. Conkey, Treasurer St. Lawrence University, Canton, until noon, July 8, for the construction, heating, plumbing, electric work and gas-piping of a building for the New York State School of Agriculture, Saint Lawrence University. Drawings and specifications may be consulted and blank forms of proposals obtained at Saint Lawrence University, Canton, N. Y., or by application to G. L. Heins, State Architect, Capitol, Albany, N. Y.

New York, N. Y.—Bids are asked by John F. Ahearn, Borough President, until 3 p. m., July 10, for labor and material required (except for plumbing work) for the erection and completion of a public bath building at Nos. 5 and 7 Rutgers place, Borough of Manhattan. Separate bids are also asked for the plumbing. Plans, etc., with the architects, Bernstein & Bernstein, 24 E. 23rd St.

New York, N. Y.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., until 11 a. m., July 8, for the following work: Repairs to heating and ventilating apparatus on public school 32, on 183rd St., Beaumont and Cambreling Aves., and Morris high school, on 166th St., and Boston Road, Borough of the Bronx; for installing heating and ventilating apparatus in new public school 43, on westerly side of Brown Pl., between 135th and 136th Sts., Borough of the Bronx; for additions to and alterations in the electric bell system of public school 86, on 96th St. and Lexington Ave., Borough of Manhattan; for the erection of outside iron stairs at annex to Girls' Technical high school, No. 146 Grand St., Borough of Manhattan; for installing electric equipment in addition to and alterations in public school 13, on west side of Anderson St., between Pennsylvania and Clifton Aves., Rosebank, Borough of Richmond; for the general construction, etc., of new public school 28, on the southwest corner of Centre St., and Garretson Ave Richmond, Borough of Richmond.

Upper Sandusky, O.—Bids are asked by Board of Education, until July 8, for erection of frame school building.

Wapakoneta, O.—Bids are asked by Board of Education, A. O. Pepple, Clerk, until noon, July 18, for the erection of a 2-story and basement brick and stone high school building to be located on South Blackhoof St., Wapakoneta.

Norristown, Pa.—Bids will be received by the Building Committee at the State Hospital for the Insane, at Norristown, Pa., until July 4, for furnishing material and erecting four (4) connecting corridors to conform with plans and specifications to be seen at the office of the Steward, State Hospital, Norristown, Pa.

Philadelphia, Pa.—Bids are asked by Brockie & Hastings, architects, 328 Chestnut St., until Thursday noon, July 11, for the erection of permanent improvements to the North Pavilion, Philadelphia Museums, 34th and Vintage Ave.

Wilkesbarre, Pa.—Bids are asked by James M. Norris, County Controller, until 2 p. m., July 18, for the construction and completion of the ventilating and heating system for the new court house building of the County of Luzerne, now being erected on river common, on the corner of North River and North Sts., Wilkesbarre.

Aberdeen, S. Dak.—Bids are asked by Regents of Education, Isaac Lincoln, Secretary, Aberdeen, until noon, July 8, for labor and material for certain plumbing and the furnishing of the necessary material therefor at the State University, in Vermillion, S. Dak.

Fort Sam Houston, Tex.—Bids are asked by L. J. Fleming, Constructing Q. M., until 11 a. m., July 24, for the following electrical work at Fort Sam Houston, Tex.: For furnishing and installing electric lighting fixtures in the following buildings: Post exchange and gymnasium, post hospital, officers' club and 2 double stable guard and shop buildings; for the electric wiring in 2 double stable guard and sbop buildings; for furnishing pole lines and making service connections to all the buildings before mentioned.

Paris, Tex.—Bids are asked by City Secretary, until noon, July 15, for the construction of a 4-story brick hospital building. Plans, etc., at the office of Barry & Smith, architects, Lamar Ave. and 18th St., Paris.

San Marcos, Tex.—Bids are asked by Rev. J. M. Carroll, President San Marcos Baptist Academy, San Marcos, until noon, July 6, for the erection and completion of a 3-story cement-stone trimmed brick building 296 ft. long x 151 ft. deep. The proposal will include a power house, heating and lighting plant and plumbing for the San Marcos Baptist Academy. Information may be obtained of the architect, Milton W. Scott, Waco Loan & Trust Bldg., Waco, Tex.

Neah Bay, Wash.—Bids are asked by S. I. Kimball, General Superintendent, U. S. Life Saving Service, Washington, D. C., until 2 p. m., July 18, for the construction of a life saving station on Waaddah Island, Neah Bay, Wash.

Cheyenne, Wyo.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., July 23, for finishing attic and miscellaneous work at the U. S. Public Building, Cheyenne, Wyo.

Roads and Streets

Items Arranged Alphabetically by States.

Wilmington, Del.—Bids are asked by Francis A. Price, Highway Commissioner, 1009½ Market St., Wilmington, until 10:30 a. m., July 9, for constructing following macadam roads: Road in Blackbird Hundred, 4.82 miles long; road in Red Lion Hundred, 3.25 miles; road in New Castle Hundred, 1.38 miles; road in St. Georges Hundred, 3.40 miles; road in Pencader Hundred, .13 miles; road in White Clay Creek Hundred, 1.79 miles; road in Mill Creek Hundred, 4.26 miles; road leading from Mt. Pleasant Station, 2.35 miles.

Chicago, Ill.—Bids are asked by Board Local Improvements, City Hall, until 10:15 a. m., July 11, for street improvement work as follows: Twelve contracts for paving with asphalt, two contracts for paving with blast furnace slag, one contract for paving with brick, and one contract for paving with granite blocks.

Hillsboro, Ill.—Bids are asked by Commissioner of Highways, City Hall, until 2 p. m., July 5, for grading public highway commonly known as the North Road, leading into Hillsboro. Plans and specifications can be seen at E. M. Stubblefield's drug store. Work is to be completed in 60 days from date of contract.

McLeansboro, Ill.—Bids are asked by Board Local Improvements, G. W. Hogan, President, until 1 p. m., July 9, for grading, filling and paving about 2½ miles of streets, the work including 44,185 sq. yds. of brick pavement and 30,370 lin. ft. of curbing. Official advertisement for the above work will be found elsewhere in this issue.

Morton Park, Ill.—Bids are asked by Board of Education, School District No. 99, until 9 p. m., July 5, for constructing 7,000 ft. of cement sidewalk around school houses. Specifications with Jno. J. Sherlock, Secretary, Hawthorne, Ill., or 1106 Fisher Bldg., Chicago.

Des Moines, Ia.—Bids are asked by Board Public Works until 11 a. m., July 9, for grading Kingman Boulevard from 35th St., to Polk Boulevard, the work requiring about 29,760 cu. yds. of grading, more or less.

Iowa City, Ia.—Bids are asked by F. H. Dondode, City Clerk, until 2 p. m., July 5, for paving Brown St. with brick, the work including 3,100 cu. yds. of grading, 5,114 lin. ft. of new stone curbing, and 9,424 sq. yds. of paving. Bids are also asked for paving Gilbert St. with brick, this work including 1,240 cu. yds. of grading, 3,298 lin. ft. of new stone curbing, and 8,261 sq. yds. of paving.

Bluffton, Ind.—Bids are asked by Frank S. Smith, City Clerk, until 8 p. m., July 19, for construction of cement combined curbs and sidewalks on portion of Spring St.

Evansville, Ind.—Bids are asked by Commissioners of Vanderburgh County at Evansville until 10 a. m., July 8, for the repair of Boonville rock road, the State rock road, and the Blue Grass rock road, with broken stone. Harry Stinson is County Auditor.

Greencastle, Ind.—Bids are asked by Clement C. Hurst, County Auditor, until 10 a. m., Aug. 1, for the grading, macadamizing, graveling, drainage, bridging, etc., of a road on the county line between Montgomery and Putnam counties, and known as the John W. Miller et al. highway, about 5½ miles.

Evansville, Ind.—Bids are asked by Board Public Works, Walter F. Wunderlich, Clerk, until 10 a. m., July 6, for grading, curbing, guttering and paving with asphalt portion of Chestnut St.; also for grading, curbing, guttering and paving portion of 10th St. with macadam.

Indianapolis, Ind.—Bids are asked by Board Public Works, until July 10, for the improvement of portions of eight streets by grading and paving roadway.

Indianapolis, Ind.—Bids are asked by Board Public Works, until July 12, for the following work: Improvement of Harlan St., by grading, graveling and rolling the roadway; improvement of Audubon Road by grading and paving the roadway; improvement of Drexel Ave. by grading and paving the roadway.

Newcastle, Ind.—Bids are asked by Board of Trustees, G. E. Martin, Clerk, until 8 p. m., July 16, for the improvement of C and D Aves., with gravel roadway and cement sidewalks.

Versailles, Ind.—Bids are asked by Common Council, Robert B. Ewing, City Clerk, until 8 p. m., July 5, for grading, draining and paving portions of several streets.

Vincennes, Ind.—Bids are asked by Board of Public Works, C. L. V. Tucker, Clerk, until 2 p. m., July 9, for the improvement of Roussillion St. from 2nd St. to Beret Ave., by grading and graveling roadway and sidewalks.

Fort Leavenworth, Kan.—Bids are asked by Capt. J. E. Normoyle, Q. M., until 11 a. m., July 19, for paving Grant Ave. from Meade to Metropolitan Aves., including curbs, gutters, drains, etc., at Fort Leavenworth.

Baltimore, Md.—Bids are asked by Board of Awards, until 11 a. m., July 10, to grade, curb, gutter and pave with macadam Belle Ave., from Garrison Ave. to Lewin Ave. Specifications at office of Commissioner for Open Streets, Hoen Bldg.

Grand Rapids, Mich.—Bids are asked by Board Public Works, Samuel A. Freshney, Secretary, until 8 p. m., July 5, for grading and paving with asphalt or bituminous macadam of North Lafayette St., from Fountain St. to East Bridge St.

Hudson, Mich.—Bids are asked by City Council, Fred A. George, City Clerk, until 2 p. m., July 12, for constructing 9,000 sq. yds. of pavement. Riggs & Sherman Co., Engineers, Toledo, O.

Kansas City, Ma.—Bids are asked by Park Commissioners, Frank P. Gossaid, Secretary, until 3 p. m., July 8, for the foulowing work: Constructing artificial stone sidewalk on Broadway; constructing artificial stone sidewalks on Maple Boulevard; constructing artificial stone combined curb and gutter on Maple Boulevard; grading Gillham road.

St. Louis, Mo.—Bids are asked by Board Public Improvements, City Hall, until noon, July 12, for the work under a number of contracts for grading, paving, etc.

Sedalia, Mo.—Bids are asked by C. E. Baker, City Clerk, until 5 p. m., July 15, for curbing portion of 16th St.

Concord, N. H.—Bids are asked by State Highway Department, A. W. Dean, Engineer, until July 5, for the following road work: Constructing 2 miles of macadam road in Nashua; constructing macadam road in Milton; constructing macadam road in Farmington.

Newark, N. J.—Bids are asked by Essex County Park Commission, 800 Broad St., until 3:30 p. m., July 9, for the construction of 16,000 sq. ft. of Portland cement sidewalks on Park Ave. and Lake St., Branch Brook Park. Bids are also asked for constructing 18,000 sq. yds. telford roadway at Weequahic Reservation. Plans, etc., at office of Engineer, 60 Clifton Ave., Newark.

Salem, N. J.—Bids are asked by Road Committee County Freeholders, until 8 p. m., July 8 (re-advertisement) for grading and placing oyster shell or gravel surface on the Quinton Road (2.65) miles, in the Township of Quinton, and the City of Salem. Specifications, etc., at the office of Howard B. Keasbey, Mecum Bldg., Salem, N. J., and at office of the State Commissioner of Public Roads, State House, Trenton, N. J.

Albany, N. Y.—Bids are asked by Frederick Skene, State Engineer and Surveyor, Albany, until noon, July 10. for the repair of the following improved roads, located in the county of Albany, N. Y.: Delaware Turnpike, Sec. 1. road No. 7; Delaware Turnpike, Sec. 2, road No. 41; Delaware Turnpike, Sec. 3, road No. 178; Delaware Turnpike, Sec. 4, road No. 198; Delaware Turnpike, Sec. 5, road No. 199; Delaware-Slingerland Road No. 92; North Road No. 124; River Road No. 193.

Brooklyn, N. Y.—Bids are asked by Bird S. Coler, President Borough of Brooklyn, until 11 a. m., July 10, for the work under six contracts for street improvements. Largest contract calls for regulating, grading, curbing and laying sidewalks on 84th St., from 18th Ave. to Stillwell Ave. The Engineer's estimate of the quantities being as follows: 10,260 lin. ft. of new curbstone to be set in concrete. 200 lin. ft. of old curbstone to be reset. 1,520 cu. yds. of earth excavation. 2,020 cu. yds. of earth filling, to be furnished. 510 cu. yds. of concrete, not to be bid for. 32,300 sq. ft. of cement sidewalk.

Syracuse, N. Y.—Bids are asked by Board of Contract and Supply, George J. Metz, City Clerk, until 1:30 p. m., July 8, for labor and materials for constructing stone, cement, asphalt or brick sidewalks on a number of streets.

Chardon, O.—State Highway Commissioner Huston, Columbus, O., is advertising a highway proposed under the new Ohio law, for letting at Chardon, Geauga County, July 16. Specifications will be mailed to contractors upon application.

Cincinnati, O.—Bids are asked by County Commissioners, Fred Dreihs, Clerk, until noon, July 19, for the following county work: Under Specifications No. 627—Improvement of Taylor Creek Road, from a point 290 ft. south of Brown and Seims' line to a point 2,400 ft. northwardly, Colerain Township. Under Specifications No. 638—Improvement of the Lick Run Pike, from the end of the granite paving in Queen City Ave. to the corporation line of the city, Green Township. Under Specifications No. 639—For repair of Langdon Road, from west corporation line of Pleasant Ridge to Carthage Ave. and Carthage Ave. from Langdon Road to Reading Road. Columbia and Millcreek Townships. Under Specifications No. 645—For repair of Reading Pike, between Dayton Pike and county line, Sycamore Township. Under Specifications No. 644—For improvement of the Rich Road, from Warren County to Fallis Road, Symmes Township.

Cincinnati, O.—Bids are asked by Board of Public Service, M. J. Keefe, Clerk, until noon, July 10, for grading, curbing and paving portion of Grandin Road.

Cincinnati, O.—Bids are asked by Board of Public Service, M. J. Keefe, Clerk, until noon, July 15, for improvement of Beechmont Ave., by grading, paving, etc.

Cleveland, O.—Bids are asked by County Commissioners, Julius C. Dorn, Clerk, until 11 a. m., July 27, for the following work: Repairing the pavement on Bentleyville road, in Chagrin Falls Township; repairing the pavement on the Berea road, from Kamm's Corners to Pincombe's Corners, in accordance with the form of contract and specifications to be furnished by A. B. Lea, County Engineer.

Columbus Barracks, O.—Bids are asked by Capt. H. M. Chamberlin, Constructing Q. M., until 10 a. m., July 19, for construction of a brick road pavement, concrete side walks, gutters, etc., at Columbus Barracks.

Dayton, O.—Bids are asked by Board Public Service, W. A. Maynes, Clerk, until noon, July 9, for paving Clay St., from 5th to Richard, the working including 3,780 sq. yds. of brick with straight curb. 3,450 sq. yds. of brick, sheet asphalt or bituminous macadam with combined cement curb and gutter, 2,270 lin. ft. straight stone curb, 2,430 lin. ft. combined cement curb and gutter, etc.

Findlay, O.—Bids are asked by the Commissioners of Hancock County, until noon, July 20, for the construction of three miles of stone pike between 17 and 20, 16 and 21, 15 and 22, in Orange Township, Hancock County, O., known as the Lattles Road. Bids are also asked for the construction of 1¾ miles of stone pike between sections 18 and 19 and 17 and 20 in Van Buren Township, Hancock County, O., and known as the Bormuth Road. Plans, etc., at office of County Surveyor.

Painesville, O.—State Highway Commissioner Huston, Columbus, O., is advertising a highway proposed under the new Ohio law, for letting at Painesville, Lake County, July 23. Specifications will be mailed to contractors upon request.

Pleasant Ridge, O.—Bids are asked by W. C. Davies, Clerk Board of Control, until noon, July 8, for construction of artificial stone sidewalks on east side of Robinson Road; also on north side of Cypress Ave. Certified check for $100 for each road required with bid.

St. Bernard (P. O. Cincinnati), O.—Bids are asked by George Schroeder, Village Clerk, until noon, July 10, for labor and material for improvement of Sullivan Ave. by grading, paving roadway with macadam, constructing concrete curb and gutter, etc., in accordance with the plans and specifications on file in the Clerk's office, and in the office of J. A. Stewart, Village Engineer, 712 Traction Bldg., Cincinnati, O.

Harrisburg, Pa.—Bids are asked by W. H. Lynch, Commissioner of Highways, until noon, July 8, for the paving and curbing of the following highways: Angle Alley, Curtis Alley, South Alley, Hummel St., Dauphin St., Elm St., 17th St., 5th St., Walnut St. (resurfacing), Green St., Maclay St., 18th St.

Green Bay, Wis.—Bids are asked by Committee on Streets and Bridges, John Gross, Chairman, care City Clerk, until 10 a. m., July 15, for grading and paving with asphalt portions of East Mason St., Ashland Ave. and School Pl.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., July 9, for resurfacing with asphalt, on the present concrete foundation, the roadway of Jefferson St. from the north curb line of Mason St. to the south curb line of Juneau Ave.

Oshkosh, Wis.—Bids are asked by Board Public Works, until noon, July 20, for furnishing all material and doing all the work of grading a tar macadam pavement on Northwestern Ave. from Mt. Vernon St. to Broad St. Bids are also desired for constructing a macadam roadway on Vine St. from Algona to Elm St.

Sewers.

Items Arranged Alphabetically by States.

Ensley, Ala.—Bids are asked by R. E. Meade, City Engineer, until noon, July 4, for certain storm sewer work in Alley "E," 22d Alley Ave. "E" and 23d and 24th Sts. in Ensley, of size varying from 42 in. to 66 in. Profiles and specifications may be seen at the City Hall. Certified check for $500 to accompany each bid.

San Jose, Cal.—Bids are asked by County Supervisors, Henry A. Pfister, Clerk, until 11 a. m., July 22, for installing a septic tank sewer system at the County Poorhouse, near Milpitas, in accordance with plans and specifications on file with Board of Supervisors.

Torrington, Conn.—Bids are asked by Board of Warden and Burgesses, until 2 p. m., July 16, for the construction of sanitary sewers, including the following: 2,800 ft. 20-in. tile pipe, 1,066 ft. 15-in. tile pipe, 3,618 ft. 12-in. tile pipe, 2,157 ft. 10-in. tile pipe, 10,876 ft. 8-in. tile pipe; 76 manholes. Walter A. Williston, Borough Engineer, 101 Main St.

Athens, Ga.—Bids are asked by Commissioners of Roads and Revenues, Jas. Barrow, Clerk, until noon, July 15, for repairing the sub and sub-structure and the building of a new steel 147½-ft. span at the Princeton bridge over Oconee River.

Chicago, Ill.—Bids are asked by Board Local Improvements, City Hall, until 10:15 a. m., July 11, for constructing system of brick and vitrified tile pipe sewers, with manholes and catchbasins in Chiltenham Pl. and other streets.

Harlan, Ia.—Bids are asked by this city, James C. Byers, Mayor, until 8 p. m., July 8, for constructing 8 in. sewer. Plans, etc., with City Clerk.

Dubuque, Ia.—Bids are asked by Edmund A. Linehan, City Recorder, until 8:30 p. m., July 5, for constructing 485 lin. ft. of 8-in. tile pipe sewer in alley between Rhomberg and Lincoln Aves. and 1,000 ft. of 8-in. sewer in Sutter St.

Newcastle, Ind.—Bids are asked by Commissioners of Henry County at Newcastle, until 10 a. m., for the construction of certain bridges. John M. Bundy, County Auditor.

Alexandria, La.—Bids are asked by Mayor and Board of Aldermen, until 7:30 p. m., Aug. 6, for the construction of approximately 5 miles of 8-in., 10-in., 12-in. and 14-in. vitrified pipe sewers and accessories. Ira W. Sylvester, City Engineer.

Barnstable, Mass.—Bids are asked by County Commissioners, until noon, July 15, for building a steel bridge on masonry piers and abutments to replace the present bridge across the Bass River, known as the lower bridge, between the towns of Yarmouth and Dennis and for filling in and constructing a road over a portion of said bridge. Plans, etc., at office of the County Commissioners, Court House, Barnstable, Mass., and at the office of S. E. Tinkham, Engineer, 715 Tremont Temple, Boston.

Crookston, Minn.—Bids are asked by A. M. Childs, City Clerk, until 8 p. m., July 9, for labor and material for constructing 560 lin. ft. 12-in. and 400 lin. ft. 9-in. vitrified pipe sewer.

St. Paul, Minn.—Bids are asked by Board Public Works, R. L. Gorman, Clerk, until 2 p. m., July 8, for constructing sewers in portions of Macalester Ave., Manitoba Ave., Litchfield St., Agate St., Western Ave., Ottawa Ave., and Dale St.

Buffalo, N. Y.—Bids are asked by Francis G. Ward, Commissioner Public Works, until 11 a. m., July 10, for constructing following sewers: 24-in. brick sewer in La Salle Ave. between Main St. and 400 ft. easterly; 15, 12 and 10-in. tile sewer in both sides of Ladner Ave., between South Park Ave. and 1,120 ft. west; 10-in. tile sewer in Newfield St., between Esser and Zinns Ave.

Jefferson, O.—Bids are asked by Commissioners of Astabula County until July 15 for furnishing the necessary labor and materials for the construction of the substructure of a steel bridge over creek on the Middle Road.

Norwood, O.—Bids are asked by Board Public Service, L. H. Gebhart, Clerk, until noon, July 13, for labor and material for constructing a storm water sewer in Foraker Terrace from Montgomery Pike to the western terminus, and in Montgomery Pike from Norwood Ave. to Foraker Terrace, the work including 1,100 lin. ft. 24-in. pipe sewer, 50 lin. ft. 18-in. pipe sewer, 100 lin. ft. 15-in. pipe sewer. Bids are also asked for labor and material for constructing a sanitary sewer in the Duck Creek Road from the south corporation line of the city to Harris Ave. and Williams Ave. from Duck Creek Road 350 ft. westwardly, this work including 200 lin. ft. 8-in. sewer pipe, 400 lin. ft. 12-in. sewer pipe, 3,800 lin. ft. 15-in. sewer pipe, 2,000 lin. ft. 18-in. sewer pipe, 2,300 lin. ft. 21-in. sewer pipe.

Steubenville, O.—Bids are asked by Board Public Service, T. W. Vance, Clerk, until noon, July 15, for constructing 300 ft. of 12 in. sewer in Alley D.

Youngstown, O.—Bids are asked by Board Public Service, W. H. McMillin, Clerk, until noon, July 8, for labor and material for construction of a sewer on Emma St., Lansing Ave. and Vine St. from Perry St. to Crab Creek.

Salt Lake City, Utah—Bids are asked by Board Public Works, F. J. Leonard, Chairman, until 11 a. m., July 5, for the following work: Constructing pipe sewers in sewer extensions No. 178, No. 180 and No. 182. Louis C. Kelsey, City Engineer.

North Battleford, Sask.—See under Bids Asked—Water Supply.

Water Supply

Items Arranged Alphabetically by States.

Chicago, Ill.—Bids are asked by Board Local Improvements, City Hall, until 10:15 a. m., July 11, for the work under one contract for constructing water supply pipe and the work under 20 contracts for constructing water service pipes.

Glencoe, Ill.—Bids are asked by Board Local Improvements, Granville D. Hall, Secretary, until 8 p. m., July 9, for construction of 2,170 ft. of 4-in. water main, 2 fire hydrants and 5 gate valves. Bids are also asked for constructing 960 ft. 8-in., 1,000 ft. 6-in. and 455 ft. of 4-in. water mains. Frank A. Windes, Engineer, Winnetka, Ill.

Joliet, Ill.—Bids are asked by this city until July 10 for constructing water mains in Chicago St.

Lena, Ill.—Bids are asked by the City Clerk until 2 p. m., July 6, for the construction of a 150,000-gallon concrete reservoir, estimated to cost $2,500. Plans on file at clerk's office and at office of City Engineer of Freeport, Ill.

New Orleans, La.—Bids are asked by Sewerage and Water Board, F. S. Shields, Secretary, until 3 p. m., Sept. 4, for the hauling and laying of approximately 250 miles of cast-iron water pipe, from 4 to 30 in. in diameter and aggregating about 26.000 tons. The work will be divided into four contracts.

Baltimore, Md.—Test Well.—Bids are asked by Board of Awards, until 11 a. m., July 10, for sinking a test well on the site of the proposed new sewage pumping station. This well will be 12 ft. square on top outside the sheeting and is to be carried to a depth of approximately 30 ft. below the surface of the ground. Plans, etc., at the office of the Chief Engineer of the Sewerage Commission, Room 904 American Bldg., Baltimore.

St. Paul, Minn.—Bids are asked by Captain Edward H. Schulz, U. S. Engrs., P. O. Box 654, St. Paul, Minn., until 11 a. m., July 20, for the reconstruction of Sandy Lake reservoir dam.

Omaha, Neb.—Bids are asked by this city, until July 22, for furnishing and laying 5,000 ft. of 4 in. and 1,520 ft. of 6-in cast iron water mains.

East Hamburg, N. Y.—Bids are asked by American Pipe Mfg. Co., Fidelity Bldg., Philadelphia, Pa., until July 8 (change of date from July 1), for the construction of a 10,000,000-gallon distributing reservoir on the Charles Sickman farm, located one mile east of Titus Hill station, 10 miles from Buffalo, N. Y., on the Buffalo, Rochester & Pittsburg Railroad in East Hamburg.

New York, N. Y.—Bids are asked by John H. O'Brien, Commissioner Water Supply, Gas and Electricity, 13 Park Row, until 2 p. m., July 11, for furnishing, delivering and laying water mains in New Chambers, Water, Oliver, Henry and Pike Sts., in James Slip. Security required is $20,000.

Cincinnati, O.—Bids are reported asked by Board Public Service, until July 6, for labor and material for extending water mains in Hunter Ave. and Washington Ave.

Philadelphia, Pa.—Bids are asked by George R. Stearns, Director Department Public Works, until noon, July 8, for work under Contract No. 121—extension of injection pipe at Lardner's Point Pumping Station. Specifications, drawings and blank forms upon which bids must be made can be obtained from the Chief Engineer of the Bureau of Filtration, Room 712, City Hall, to whom all communications should be addressed.

North Battleford, Sask.—Bids are asked by S. Crookson, Secretary-Treasurer, until 6 p. m., July 31, for the installation, etc., of water works, sewerage and electric lighting systems in the town of North Battleford. Plans, etc., with Secretary-Treasurer, and at office of Willis Chipman, Engineer, 103 Bay St., Toronto, Ont.

Bloomer, Wis.—Bids are asked by this village until 4 p. m., July 12, for complete water works system, consisting of steel tank, gasoline engine and deep well pump, small brick building and distribution pipe line system. Oscar Claussen, Consulting Engineer, St. Paul, Minn.

Excavation—Earth and Rock

Items Arranged Alphabetically by States.

Pensacola, Fla.—Railroad Grading.—Bids are asked by B. K. Roberts, Interstate Contract Co., 224 Brent Bldg., until noon, July 10, for grading 40 miles of railroad, etc. The work to be graded covers 20 miles of the Andalusia Division, and also 20 miles of the Atmore Division, of the Pensacola, Alabama & Western R. R.

Carroll, Ia.—Ditch Work.—Bids are asked by Peter Stephany, County Auditor, until 2 p. m., July 24, for constructing ditch in Drainage District No. 16, Jasper County, The work consists of 9,600 ft. of main ditch requiring 5 in., 8 in., 10 in., 12 in. and 15 in. tile and 1,500 ft. of laterals made up of 6-in. tile. Specifications with County Auditor.

Des Moines, Ia.—River Improvement.—Bids are asked by Board Public Works, until 11 a. m., July 10, for the improvement of the channels of the Raccoon River and the Des Moines River within the corporate limits of the city of Des Moines. Work to begin on or before Aug. 10, 1907, and to be completed on or before April 1, 1901. Certified check for $35,000 required with bid. Geo. D. Dobson, City Engineer.

Emmetsburg, Ia.—Drainage Work.—Bids are asked by County Supervisors, Sim R. Stedman, County Auditor, until 1 p. m., Aug. 7, for constructing drainage improvements in a number of districts. Largest amount of work is to be done in Drainage District No. 15, this work being divided into 19 sections and including the laying of a considerable amount of tile; also the excavation of 20,200 cu. yds. of earth. Seven drainage districts are to be improved.

Nevada, Ia.—Ditch Work.—Bids are asked by F. G. Dunahugh, County Auditor, until 11:30 a. m., Aug. 1, for the construction of a ditch or drain in the Marshall-Story Drainage District No. 1 as follows: Section 1, 5,130 ft. open ditch, about 6,500 cu. yds. Sec. 2, 5,000 ft. 30-in. tile, 2,800 ft. 26-in. tile. Sec 3, 3,000 ft 20-in. tile, 3,400 ft 18-in. tile, 5,400 ft. 16-in. tile, 4,200 ft. 12-in. tile. Sec 4, 5,500 ft. 16-in tile, 1,200 ft. 14 in. tile, 1,800 ft 12-in. tile. Sec. 5, 2,000 ft 20-in. tile, 4,100 ft 18-in. tile, 2,900 ft. 14-in. tile Sub-Branch 1 of Sec. 5, 1,800 ft. 12-in. tile, 200 ft. 14-in tile.

Martinsville, Ind.—Ditch Work.—Bids are asked by Frank A. Dobbs, Commissioner of Construction of Morgan County, at Martinsville, until 2 p. m., July 6, for the construction of a ditch on petition of Henry J. Ratts.

Rochester, Ind.—Ditch Work.—Bids are asked by A. C. Davidson, Construction Commissioner of Fulton County, at Rochester, until 2 p. m., July 6, for the construction of three ditches.

Grand Rapids, Mich.—Rock Excavation, Etc.—Bids are asked by Board Public Works, Samuel A. Freshney, Secretary, until 8 p. m., July 18, for constructing 4,000 cu. yds. concrete walls, excavating 18.000 cu. yds. rock and 8,000 cu. yds. earth, in connection with flood protection work at Grand Rapids, according to plans and specifications on file at the office of the City Engineer, L. W. Anderson.

Minneapolis, Minn.—Railroad Grading.—Twin City & Lake Superior Ry. Co., 345 Railway Bldg., Minneapolis, is reported to be taking bids for grading 40 miles of road.

Newark, N. J.—Dredging.—Bids are asked by Col. D. W. Lockwood, U. S. Engrs., Room C-8, Army Bldg., 39 Whitehall St., New York City, until noon, July 30, for dredging in Newark Bay and Passaic River, New Jersey.

Woodbridge, N. J.—Dredging.—Bids are asked by Col. D. W. Lockwood, U. S. Engrs., Room C-8, Army Bldg., 39 Whitehall St., New York City, until noon, July 27, for dredging in Woolbridge Creek, New Jersey.

New York, N. Y.—Dredging.—Bids are asked by Lt. Col. W. L. Marshall, U. S. Engrs., Army Bldg., New York, until noon, July 24, for dredging in Bay Ridge and Red Hook Channels, New York Harbor.

New York, N. Y.—Dredging.—Bids are asked by Col. John G. D. Knight, U. S. Engrs., Room F-7, Army Bldg., New York, N. Y., until noon, July 24, for dredging in mouth of Schodack Creek, Hudson River, N. Y.

San Juan, P. R.—Dredging.—Bids are asked by Major Chas. L. Potter, U. S. Engrs., Thompkinsville, N. Y., until 11 a. m., Aug. 7, for dredging in San Juan Harbor, Porto Rico.

Charleston, S. C.—Dredging.—Bids are asked by Capt. G. P. Howell, U. S. Engrs., Charleston, S. C., until noon, July 20, for

Miscellaneous

Items Arranged Alphabetically by States.

Fort Morgan, Ala.—Wharf Repairs, Etc. Bids are asked by Capt. L. F. Garrard, Jr., Box 605, Mobile, Ala., until 11 a. m., July 23, for furnishing labor and material for filling and top soiling the reservation and repairing wharf at Fort Morgan, Ala.

Oakland, Cal.—Street Sweeping.—Bids are asked by Board Public Works, Walter B. Fawcett, Secretary, until 10 a. m., July 10, for sweeping and cleaning by machinery during the fiscal year ending June 30, 1908, such public streets of the city of Oakland as are or may be paved with bituminous rock or wood blocks.

Chicago, Ill.—Derricks.—Bids are asked by John J. Hanberg, Commissioner Public Works, until 11 a. m., July 8, for furnishing all labor and material and do all the work necessary to build and construct in the best and most workmanlike manner complete and ready for use, three 5-ton power stiff-leg derricks, rigged complete, with bull wheels, engines, ropes, and blocks.

National Military Home, Kan.—Renewing Steam Pipes.—Bids are asked by Major W. W. Mortin, Treasurer, Western Branch, N. H. D. V. S., National Military Home, until noon, July 5, for renewing the main steam supply and return pipes in the tunnel from the main junction to its intersection with the lateral tunnel from the library at the Western Branch, N. H. D. V. S.

Boston, Mass.—Concrete Floor.—Bids are asked by Bureau of Yards and Docks, Navy Department, Washington, until 11 a. m., July 27, for constructing a reinforced concrete floor, building No. 107, Navy Yard, Boston, Mass.

Holland, Mich.—Pier Repairs.—Bids are asked by Col. M. B. Adams, U. S. Engrs., 57 Park St., Grand Rapids, Mich., until 3 p. m., July 26, for repair of north pier at Holland, Mich.

Brooklyn, N. Y.—Bids are asked by M. Craven, Commissioner of Street Cleaning, 13 Park Row, New York, until noon, July 9, for contract for furnishing all the labor and materials required for the final disposition of all ashes, street sweepings and rubbish for a period of five years, beginning Oct. 28, 1907. The work is divided into contracts, the security required for each contract being $100,000.

Brooklyn, N. Y.—Riprap Sea Wall.—Bids are asked by Park Board, 5th Ave. and 64th St., New York, until 3 p. m., July 18, for furnishing all the labor, plant and materials necessary to construct and complete riprap sea wall along the Bay Ridge Parkway, from Wakeman Pl. to Fort Hamilton Ave., Borough of Brooklyn, together with all work incidental thereto. Security required is $60,000. Plans, etc., at office of Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn.

New York, N. Y.—Retaining Wall.—Bids are asked by George Cromwell, President Richmond Borough, St. George, New Brighton, until noon, July 30, for furnishing all the labor and materials required for constructing reinforced concrete retaining walls on Jay St. and South St., and other work in connection with the St. George Ferry approach. The work includes 9,400 cu. yds. of concrete in place, including forms; 1,100,000 lbs. of steel in place; 23,000 cu. yds. of excavation, 2,500 lin. ft. of granite coping on parapet wall; 4,950 sq. ft. of granite facing; 40,000 lin. ft. piles furnished, driven and cut, etc.

New York, N. Y.—Planting Trees, Etc.—Bids are asked by Park Board, 5th Ave. and 64th St., until 3 p. m., July 11, for furnishing and planting trees, garden mold, sodding, etc., along the various streets in the Borough of the Bronx. Security required is $25,000. Plans may be seen at the office of the Department of Parks, Zbrowski Mansion, Claremont Park, Borough of the Bronx.

West Point, N. Y.—Steam Piping.—Bids are asked by the Quartermaster, West Point, until noon, July 16, for furnishing and installing steam piping for power house and distributing system.

Petit Rocher, N. B.—Breakwater Extension.—Bids are asked by Frederich Gelmas, Secretary Department Public Works, Ottawa, Ont., until July 15, for construction of an extension of breakwater at this place.

Newport, R. I.—Garbage Plant.—Bids are asked by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 16, for the construction of one garbage incinerating plant at the naval training station, Newport, R. I. Applications should refer to Schedule 32.

Fort D. A. Russell, Wyo.—Garbage Crematory.—Bids are asked by Capt. V. K. Hart, Constructing Q. M., Cheyenne, Wyo., until 10:30 a. m., July 22, for furnishing all material and labor required for the construction, complete, as per specifications on file in this office, a garbage crematory at Fort D. A. Russell, Wyo

Materials, Machines, Supplies, Tools, Etc

Items Arranged Alphabetically by States.

Mare Island, Cal.—Cement, Pipe, Etc.—Bids are asked by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 23, to furnish at the navy yard, Mare Island, Cal., a quantity of naval supplies, among which are the following: Schedule 46—Broken stone, sand, hardware, Oregon pine, corrugated steel, steel shapes and plates, rails. Schedule 47—Broken stone, Portland cement, brick, lime, sand, rivets, spikes, wire netting, lumber, platinum, bar iron, corrugated steel, steel shapes and plates, rails, asbestos millboard. Schedule 48—Steel plates. Schedule 49—Bath tubs lavatory fittings, Oregon pine, tallow wood, iron or steel pipe, steel tubing, copper pipe, lenses.

San Francisco, Cal.—Boilers.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 30, to furnish two 100-H.-P. stationary water-tube boilers at the naval training station, San Francisco, Cal. Applications for proposals should refer to Schedule 54.

Washington, D. C.—Steam Shovels, Plows, Etc.—Bids are asked by D. W. Ross, General Purchasing Officer, Isthmian Canal Commission, until 10.30 a. m., July 16, for furnishing under Canal Circular 374—Steam shovels, unloader plows, push and hand cars, car replacers, jacks, rail benders, track tools, picks, shovels, tool handles, wheelbarrows, track torpedoes, lantern globes, iron pipe and fittings, valves, bibbs, gauge cocks, oakum, oakum felt, steel wool, etc.

Washington, D. C.—Drafting Materials.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C. until 3 p. m., July 16, for furnishing and delivering the drafting materials required in accordance with the specification and schedule, copies of which may be had at his office.

Washington, D. C.—Dynamite, Blasting Material, Etc.—Bids are asked by D. W. Ross, General Purchasing Officer, Isthmian Canal Commission, until 10:30 a. m., July 8, for furnishing under Circular No. 373, dynamite and blasting material, carborundum wheels, etc. About 700,000 lbs., 45% nitroglycerine, 1¼ in. by 8 in. cartridge, 50,000 lbs. 45%, 1 in. by 8 in. cartridge and 500,000 lbs., 60% nitroglycerin, 1¼ in. by 8 in. cartridge, are required.

Washington, D. C.—Portable Track, Cement, Etc.—Bids are asked by Bureau Supplies and Accounts, Navy Department, Washington, until 10 a. m., July 16, for furnishing at various navy yards a quantity of naval supplies, among which are the following: Schedule 55, air hose, Portland cement, gravel, sand, railroad hardware, ties, steel angles, rails, wheelbarrows, steel cars, push carts, portable track; schedule 58, crucible steel wire; schedule 59, electrical conductor and conduit, motor drive outfits, conductor and conduit and fittings; schedule 63, bolts, etc., yellow pine, creosoted yellow pine plank and piles, bar iron; schedule 64, files, screws, hose, iron or steel pipe, valves.

Bloomington, Ill.—Electric Equipment.—Bids are asked by Harry E. Rhoades, City Clerk, until 8 p. m., July 9, for reconstructing electric light plant. Engine, generator, arc lamps, surface condenser, etc., will be required. A. T. Maltby, Engineer, 803 Great Northern Bldg., Chicago.

Chicago, Ill.—Boiler Feed Pump.—Bids are asked by John J. Hanberg, Commissioner Public Works, for furnishing and delivering on the boiler room floor of the 14th street pumping station of the city of Chicago, Corner 14th St. and Indiana Ave., two boiler feed pumps of a size sufficient to supply 35,000 lbs. of water per hour and according to specifications on file in the office of the Department of Public Works, Room 325, City Hall.

Lebanon, Ill.—Engine.—Bids are asked by the City Clerk, until July 2, for furnishing an engine for the municipal electric light plant.

Fort Wayne, Ind.—Water Pipe. Bids are asked by Board Public Works, Julian F. Franke, Clerk, until July 9, for furnishing 10,000 ft. of 6-in. cast iron water pipe.

St. Paul, Minn.—Electric Elevator.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., July 12, for an electric passenger and freight elevator in the U. S. Post Office, Court House and Custom House building, St. Paul, Minn.

Kansas City, Mo.—Fire Hydrants.—Bids are asked by Board of Public Works, Everett Elliott, Secretary, until 2 p. m., July 12, for furnishing, f. o. b. cars, Kansas City, 300 standards, 5-in., double nozzle, fire hydrants, with fire steam connection; specifications on file in the office of the Water Department.

Omaha, Neb.—Electric Elevator.—Bids are asked by Major Thos. Swobe, Q. M., Army Bldg., Omaha, until 11 a. m., July 25, for installing an electric freight elevator in commissary store house at quartermaster's depot, Omaha, Neb.

Hoboken, N. J.—Bids are asked by Fire Commissioners, D. A. Haggerty, Clerk, until 8 p. m., July 23, for furnishing one new first size steam fire engine and two new 60-gallon single-tank combination chemical engines and hose wagons.

Philadelphia, Pa.—Pipe, Feed Water Heater, Etc.—Bids are asked by George R. Stearns, Director Public Works, until noon, July 8, for furnishing the following for Bureau of Filtration: Contract No. 113, feed water heater, Lardner's Point pumping station, boiler house No. 2; Contract No. 120, furnishing breeches pipe; Contract No. 122, furnishing lumber at Torresdale filters; Contract No. 123, furnishing flange pipe. Specifications, etc., with Chief Engineer, Bureau of Filtration, Room 712, City Hall.

Charleston, S. C.—Lumber, Rubble Stone.—Bids are asked by Capt. G. P. Howell, U. S. Engrs., until noon, July 11, for furnishing creosoted lumber and rubble stone.

BIDS RECEIVED.

Brooklyn, N. Y.—School House Addition.—Bids as follows were received June 17, for the general construction, etc., of additions to and alterations in Public School 75, northwest corner of Evergreen Ave. and Grove St., Borough of Brooklyn: Matthews Realty & Construction Co., Brooklyn, $220,000; Patrick Gallagher, 1183 Broadway, New York, $211,800; Thos. Cockerill & Son, 147 Columbus Ave., New York, $211,850; George Hilderbrand, 38 Park Row, New York, $208,777; Jas. McArthur, 22 Ormond Pl., Brooklyn, $211,461; P. J. Brennan & Son, Fuller Bldg., New York, $214,000; George F. Driscoll, Richmond, S. I., $214,200; John Aver & Son, 957 Broadway, Brooklyn, $211,965; Peter Cleary, 235 Bainbridge St., Brooklyn, $212,000.

Brooklyn, N. Y.—School Building.—Following bids were received June 3 for the general construction, etc., of new Public School 156, on Sutter Ave., Grafton and Barrett Sts., Borough of Brooklyn: F. T. Nesbit Construction Co., 116 Nassau St., $454,950; Clarke & Stowe, 221 Green point Ave., Brooklyn, $449,300; Chas. H. Peckwerth, 415 Hudson St., New York, $452,214; Jno. Kennedy & Son, 175 Front St., Brooklyn, $493,000; Thos. Cockerill & Son, 147 Columbus Ave., New York, $498,000; George Hildebrand, 38 Park Row, New York, $462,400; P. Gallagher, 1183 Broadway, New York, $478,306; James McArthur, 22 Ormonde Pl., Brooklyn, $509,994, John Auer & Son, 957 Broadway, Brooklyn, $451,288.

Brooklyn, N. Y.—Heating and Ventilating.—Bids as follows were received June 24 for installing heating and ventilating apparatus for new public school 152, on south side of Avenue G, between East 23rd and East 24th Sts., Borough of Brooklyn: R. J. Sovereign & Co., 63. 5th Ave., New York, $39,621; E. Rutzler & Co., 127 White St., New York, $35,275; Blake & Williams, 211 West 20th St., New York, $36,746; Frank Dobson, 319 East 53rd St., New York, $39,919.

Long Island City, N. Y.—Garbage Disposal.—Following bids were received June 26 for final disposition of garbage in 5th Ward for period of three years: Long Island Construction & Supply Co., Long Island City, $10,500 per year; E. J. McKeever, Astoria, L. I., $12,500 per year; George F. Vreeland, $12,000 per year.

Long Island, City, N. Y.—Regulating and Grading.—Bids as follows were received June 26 for regulating and grading the boulevard from Webster Ave. to Broadway, 1st Ward, Borough of Queens: Atlanta Contracting Co., 434 East 91st St., New York, $70,580; D. W. Moran, 562 Burnside Ave., New York, $78,149; Jas. A. Boyce & Co., $67,151; Pease Bros., Astoria, L. I., $62,334; Astoria Construction Co., $71,828; Thos T. Tuohy & Co., Flushing, L. I., $70,119; Henry J. Miller, $70,166.

Long Island City, N. Y.—Floating Bath. Long Island Construction & Supply Co., Long Island City, was only bidder June 26 for construction floating baths, its bid being $14,725.

New York, N. Y.—Heating and Ventilating.—Following bids were received June 24 for installing heating and ventilating apparatus for additions to and alterations in public school 23, on the corner of Whitestone Ave. and State St., Flushing, Borough of Queens; all bidders from New York City: R. J. Sovereign & Co., 63, 5th Ave., $15,600; E. Rutzler & Co., 127 White St., $16,179; Gillis and Groghegan, 537 W. Broadway, $15,000; Isaac B. Meirrett, 48 Cliff St., Wm. J. Olvaney, 177 Christopher St., $16,463.

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New York, N. Y.—Widening Bridge Roadway.—Following bids were received June 13 for widening roadways on Manhattan approach of Brooklyn Bridge: J. H. Gray & Co., 949 Broadway, $190,000; Chas. Meads & Co., 299 Broadway, $151,100; Williams Engineering & Contracting Co., 21 Park Row., $149,843; Cooper & Evans Co., 220 Broadway, $111,235; Snare & Triest Co., 143 Liberty St., $141,400.

New York, N. Y.—Public Bath.—Following bids were received June 10, for erections of public bath building at 5 Rutgers Pl.: John H. Parker, 225, 4th Ave, $179,375; Calumet Construction Co., 15 East 59th St., $168,621; Patrick Gallagher, 1183 Broadway, $156,900; S. D Davis, New York, $197,900; Kelley & Kelly, 45 East 42d St., $176,751; Luke A. Burke & Son, 25 West 42d St., $178,200; L. J. Waters, Park Ave. and 125th St., $181,498; F. T. Nesbit Construction Co., 116 Nassau St., $159,400.

New York, N. Y.—Subway.—Following bids were received June 13 for constructing section of rapid transit subway in Centre St. to the Bowery; (1) stands for subway proper and (2) for pike gallery: Cranford Co., 52 9th Ave., Brooklyn, (1) $1,690,000, (2) $45,000; Degnon Contracting Co., 60 Wall St., (1) $1,938,000, (2) $60,000; Patrick McGovern, Boston, Mass., (1) $1,950,000, (2) $60,000; Bradley Contracting Co., 154 E. 24th St., $1,518,302, (2) $29,040.

BRICK PAVING.

Wooster, Ohio.

The Board of Public Service of the City of Wooster, Ohio, until Saturday, July 6, 1907—12 o'clock noon, will receive bids for the improvement of Bever Street, from South Street to Spring Street, by grading, curbing with stone and paving with vitrified brick on stone and gravel foundation. Estimate is 11,230 sq. yds. of paving complete between curbs, 6,200 feet of straight and 222 feet of curved curbing.

J. L. EBERHARDT,
26-2t City Civil Engineer.

NOTICE TO CONTRACTORS.

Rubble Concrete Dam.

The North Poudre Irrigation Company of Fort Collins, Colorado, will receive sealed bids until 10 o'clock a. m. of the 8th day of July, 1907, for the construction of a rubble concrete dam across the North Fork of Cache La Poudre River near Livermore, Larimer County, Colorado, maximum height about 80 feet and length about 329 feet.

This work comprises approximately the following quantities:

Rubble concrete construction....	17,500 cu. yds.
Excavation earth and loose rock	5,000 cu. yds.
Excavation solid rock.............	500 cu. yds.

The cement used in this work will be furnished by The North Poudre Irrigation Company. The aggregate for the concrete can be obtained at the dam site. Plans and specifications for the above dam will be on file at the office of the Secretary of the above company at Fort Collins on and after June 7, 1907.

A certified check made payable unconditionally to the order of the Treasurer of The North Poudre Irrigation Company for an amount equal to five per cent of the bid must accompany each bid.

The right to reject any or all bids is reserved.

M. E. KAUFMAN,
Secretary.
S. G. SWIGART,
Chief Engineer.
23-4t

BRICK PAVING.

Bids will be received by the board of local improvements of the city of McLeansboro, Illinois, up to July 9th, 1907, at one o'clock p. m., for grading, filling and paving about $2\frac{1}{4}$ miles of streets of said city, aggregating to-wit:

11,185 Square yards of pavement; 30,370 linear feet of curbing.

Paving to be of the following general construction:

A five-inch Portland cement concrete base, a two-inch sand cushion, a layer of repressed, vitrified shale block or brick with the interstices filled with asphalt, and curbing on each side of pavement.

All persons desiring to bid on this work may address G. W. Hogan, president of the board of local improvements, or the city clerk of said city.

HARRY ANDERSON,
27-1t City Attorney.
McLeansboro, Ill.

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Sealed proposals will be received by the State Water Supply Commission at its office, No. 23 South Pearl St., Albany, N. Y., on July 12, 1907, at 12 o'clock noon, for straightening, deepening and improving Canaseraga Creek, Kishaqua Creek, and other ditches in Livingston County, N. Y.

The work includes about 677,100 cubic yards of earth excavation; 10,200 cubic yards of earth filling and embankment; clearing and grubbing; 15,000 lineal feet of round timber; 89,300 feet of sawed timber; 460 piles, 1,690 cubic yards of concrete; 358,000 pounds structural steel for bridges, and 3,800 lineal feet of pipe railing.

Specifications, bidding sheets and form of contract may be obtained on application to the Secretary of the State Water Supply Commission at his office, 23 South Pearl St., Albany, N. Y., or from the resident engineer, Walter McCulloh, at Dansville, N. Y., or from the consulting engineer, Myron S. Falk, at 60 Wall St., N. Y.

Proposals will be received both for the entire work, or for any one of the nine sections, into which the work has been divided.

The right is reserved to reject any or all bids.

Bids must be made in strict accordance with the Instructions for Bidders, attached to the proposal books.

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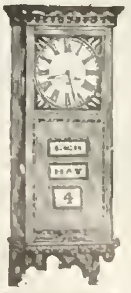

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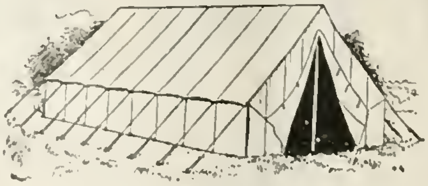

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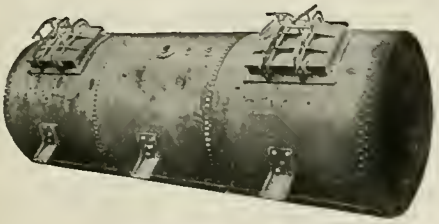

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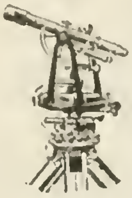

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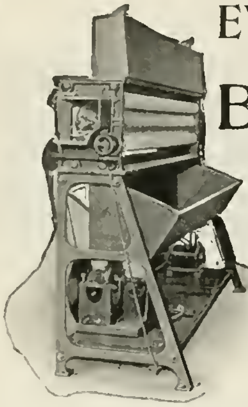

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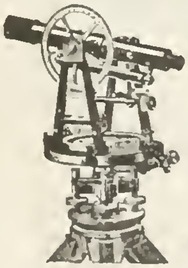

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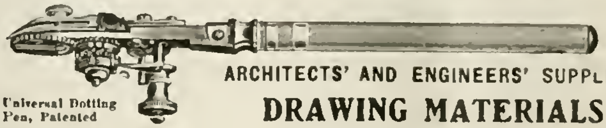

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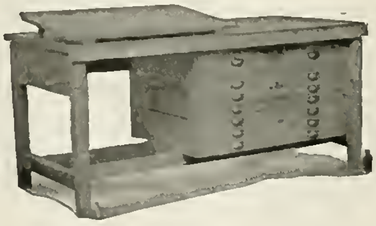

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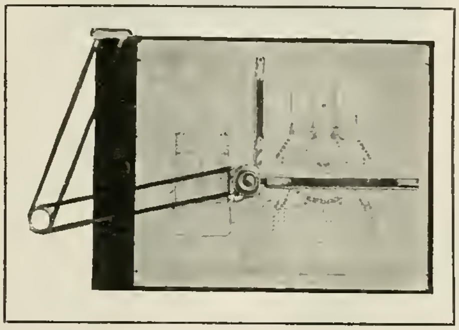

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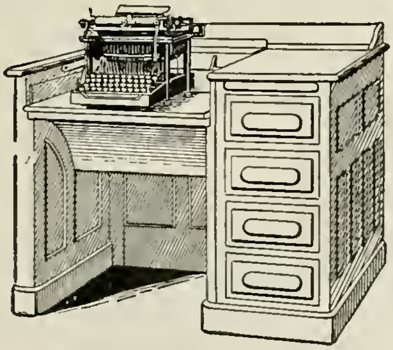

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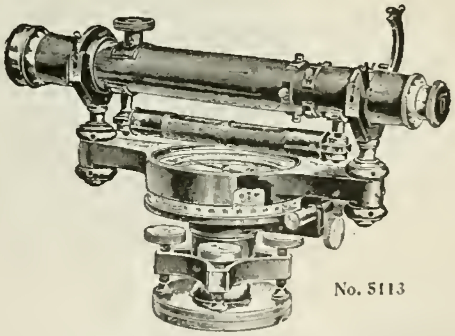

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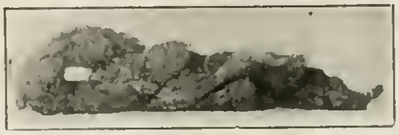

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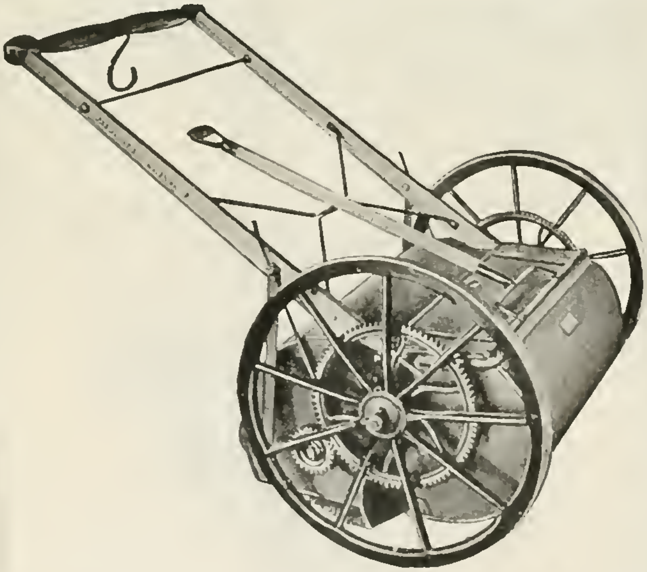

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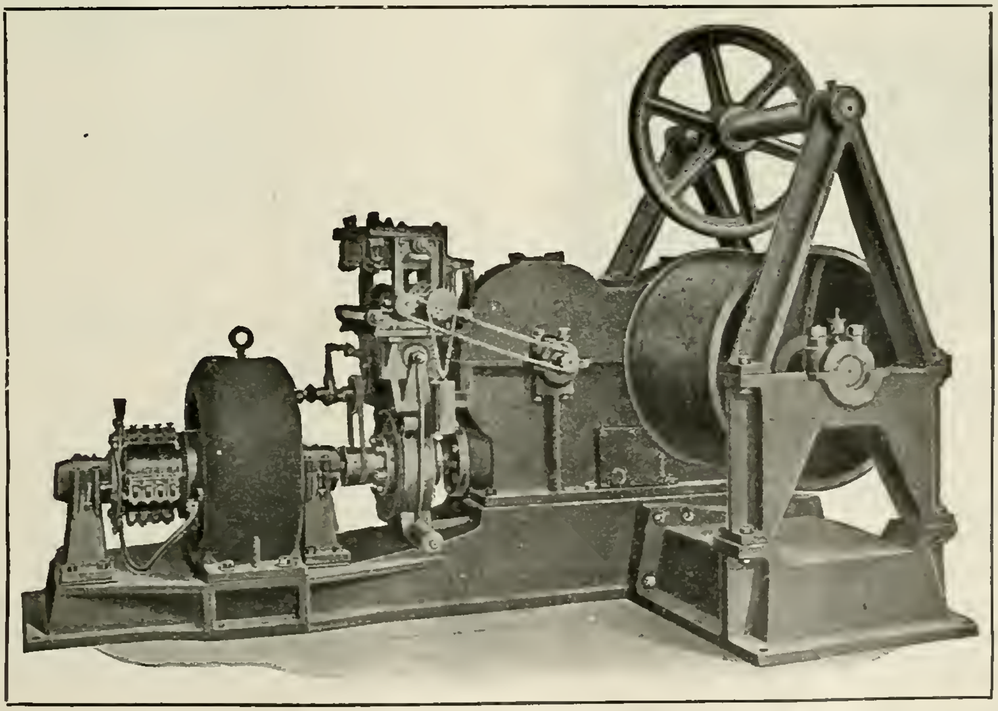

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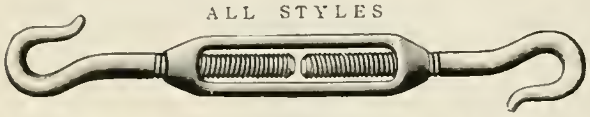

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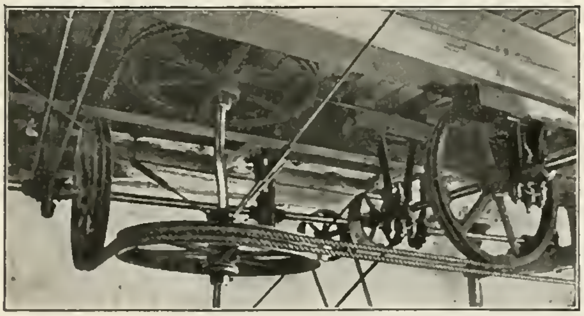

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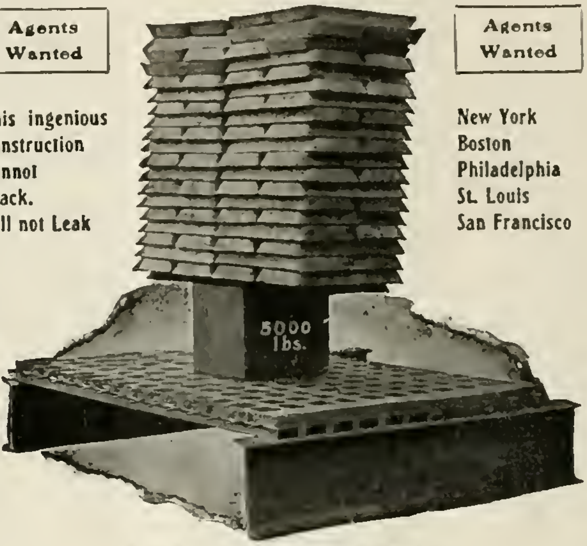

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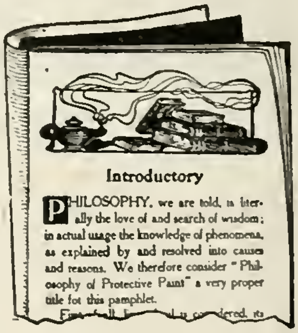

Introductory

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A Common Fault in Proposal Advertisements.

In preparing the contract news for successive issues of this journal the editor is called upon to read several hundred proposal advertisements every month. A remarkable variation exists in the character and contents of these advertisements. Some of them give large space to certain features which others neglect almost entirely to mention. Some are explicit and others are vague and general—indeed it is common to see advertisements so written that no definite idea of the work in hand can be gotten from them. To the lay mind there seems to be something queer and unbusinesslike in this condition. A proposal advertisement has or should have a definite purpose. It costs money to have it published and if the money is not to be counted as wasted the advertisement must attract the attention of contractors sufficiently to interest them to bid on the work.

There are at least three facts which a contractor wishes to be informed about by a proposal advertisement. He wishes first to know the time and place at which bids are to be received. Second, he wishes to know the character and quantity of the work to be done. Finally he wishes to know the source from which detailed information of the work can be secured. There should be, it seems to us, no question as to the essential nature of all these items of information yet is more often than not that some one of them is not stated or is stated so vaguely or in such terms as to be wholly indefinite.

To illustrate a common case there is before us an advertisement for sewer work to be done in a Western city of 30,000 inhabitants which asks bids "for letting of contract for the improvement of street by the construction therein of a sewer." The advertisement tells where detailed plans may be seen, describes the penalties for non-fulfillment of contract, describes the manner of payment, etc., in much detail, but does not give a word further regarding the nature and amount of the work. So far as the advertisement tells the contractor has absolutely no information whether the sewer to be built is a thousand feet or five miles long or whether it is to be built of brick, vitrified pipe or concrete, or whether it is one foot or five feet in diameter.

Against this advertisement we will set another which tells all that the first one does and in addition says:

'The Engineer's estimate of the quantities is as follows: 45 linear feet of 15-inch pipe sewer; 1,462 linear feet of 12-inch pipe sewer; 1,944 linear feet of 6-inch house connection drain; 15 manholes; 4 sewer basins."

In both cases the city has work to purchase and desires to buy it at the lowest reasonable rate, in one case the amount of work required is stated definitely, in the other case nothing is said of the amount. Which notice is most likely to interest the contractor who has work to sell?

It is not our purpose here to discuss the problem of writing proposal advertisements in detail. The failure which we have mentioned is, however, so common a fault of such advertisements that it deserves specific mention.

The citizens of Los Angeles, Cal., have sanctioned the issue of $23,000,000 of bonds for Owens River Water Supply project.

Method of Constructing the Crockers Reef Dam, New York Barge Canal Near Fort Edward, N. Y.

BY LINDON BATES, JR.*

One of the most striking characteristics of the New York Barge Canal is the great extent to which concrete is employed. Where ten years ago masonry would have been considered the only standard construction material, now concrete has entirely usurped its place for locks, bridge abutments and dams.

In the wide view of being a typical structure of the new order as well as being the first dam of the New York Barge Canal to be built, the one at Crockers Reef, eight miles below Fort Edward, is of special interest. The bulk of the structure is of second class concrete, consisting of one part Portland cement and five parts crushed stone. Large rocks were used freely, so that about 10 per cent of the dam is so composed. The crest and the down stream slope of 6 on 5 is faced with an 18-in. layer of first class concrete, composed of one part Portland cement, two parts sand and five parts crushed stone and gravel. The Portland cement is very carefully specified and tested by the State. It must be ground to such fineness that 99 per cent by weight will pass through a sieve of 2,500 meshes to the square inch, and 92 per cent through a sieve of 10,000 meshes. Sample briquettes are subjected to tensile strains of from 240 to 500 lbs. per sq. in., and tests involving time of setting, chemical analysis and other rigorous requirements insure the standard.

At Crockers Reef the Hudson River is divided into two channels by a small rocky island. (Figs. 1 and 2.) Across these is located the dam which sustains the Fort Edward level of the New Champlain Canal. Its eastern abutment is adjacent to the new cutting and locks, beyond which is the small channel of the existing Champlain waterway. From the eastern abutment the crest stretches 480 ft. to the island. West of the island a shorter section of 280 ft. crest length closes the other river channel.

A flood elevation of 128 ft. and a minimum low water level of 119 ft. is the range of the Hudson at the dam. The crest is at the latter plane. The level below is held by the Fort Miller dam of 115.3 ft. above datum. While the maximum flood height is reached very seldom, two extension structures are required to safeguard the ends of the dam in high water—a core wall 93 ft. long and an embankment 16 ft. wide, closing a depression in the island that falls below the high water limit, and another core wall and embankment on the west bank of the river.

On April 5, 1906, the initial preparations were made. Adjoining the Champlain Canal the ground was prepared for the depot of broken stone and sand to be brought down by barges, and a derrick of 1 cu. yd.

---

*71 Broadway, New York, N. Y.

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bucket capacity was set up for unloading. Near this station was installed the concrete mixer, from which a narrow gage track was run to the river bank. (Fig. 2.) A 4-cu. yd. dump car, lined, to prevent leakage, conveyed the concrete to the various locations, where it was then placed in the forms for the dams. This method of handling the concrete proved to be very satisfactory. It was the only economical way in which it could be managed on account of the distance that the material had to be carried. The farthest interval to be traveled from the mixer to the west end of the dam was about 2,500 ft., and an average round trip on the 2,000 ft. haul consumed about seven minutes. The average construction rate was approximately 75 cu. yds. per day, but as high as 140 cu. yds. were placed in ten hours.

The excavation in shale rock for the eastern abutment wall was started on May 8, and a layer of cement mortar was set in the base before concreting started. On the bottom course, uprights for the forms of the abutment wall were placed 2 ft. apart and braced against the rock. The facing forms were 2-in. tongue-and-groove spruce, surfaced on one side. Two strands of wire, placed 4 ft. apart, vertically and horizontally, were used to tie the front and back forms together. This method of construction was followed on all the abutment wall of the dam.

Work on the dam proper was started May 24 at the mainland end of the east section. A box coffer-dam (Figs. 3 and 4) consisting of 8x8-in. timbers placed 5 ft. apart horizontally and 2½ ft. vertically, fastened by ½-in. bolts, was set in place, the truss being braced by 4x4-in. vertical posts 5 ft. apart. Two rows of 1-in. plank were then placed on the inside of the coffer-dam on each side, and sand bags were lowered to the bottom before the puddle was put in. The material for all puddle, consisting of a mixture of clay, sand and dirt, was taken from the canal prism. The down stream side of the coffer-dam was built as an apron, with two rows of 1-in. sheeting against the stringer at the south end of the trestle timbers. Along the bottom of this lap-sheeting sand bags were laid and puddle dumped on top. A trestle of rough bents composed of round logs 12 ft. apart, with two 8-in. stringers under each rail, was next built inside the coffer-dam, to be used for conveying construction materials to whatever point needed. This completed the preparatory work.

The first section of dam was about 200 ft. long. A 10-in. centrifugal pump emptied it in about 1½ hours. When a few small leaks had been stopped, excavation commenced. This consisted in drilling, blasting and excavating a channel the width of the dam and 2 ft. deep into the rock of the reef. After this trench had been excavated and passed by the State Engineers, the forms were placed.

Ribs were set every five feet of the same shape as the curve of the dam and braced against the larger timbers of the trestle overhead. The forms were then nailed on, beginning at the bottom and keeping just ahead of the concrete. This was to enable the concrete to be rammed against the forms.

As the work extended into the river, it was found that on account of the smoothness of the bottom and the swiftness of the river, and also because of deep holes which were encountered, it was necessary to change the plan of the coffer-dam and float cribs on its upper side a certain distance apart, as the conditions would warrant. After anchoring these with stone, stringers were placed across from crib to crib and 2-in. sheeting was lapped on them at an angle forming an apron dam. Old grain bags half filled with clay were dropped along the bottom of the sheeting and the clay puddle was then dropped on top. The clay that was dumped took its natural slope. The lower dam was, of course, away from the current, and it was only necessary to use a line of sheeting against the trestle with clay dumped outside. This type of coffer-dam proved very satisfactory, and little expense for pumping was incurred. After once emptying, the small leaks being stopped, the pump was shut down, and seldom used until another section of the dam was ready.

The east spillway was built in four sections. At one place on this channel the water was found to be 30 ft. deep, and it was very difficult to procure a tight dam at

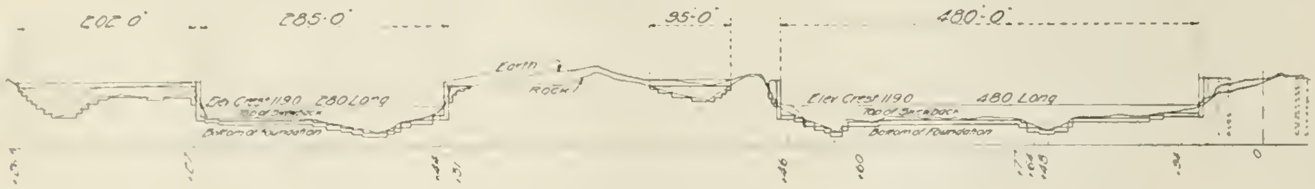


Fig. 1.—Profile of Crocker's Reef Dam, New York State Barge Canal.

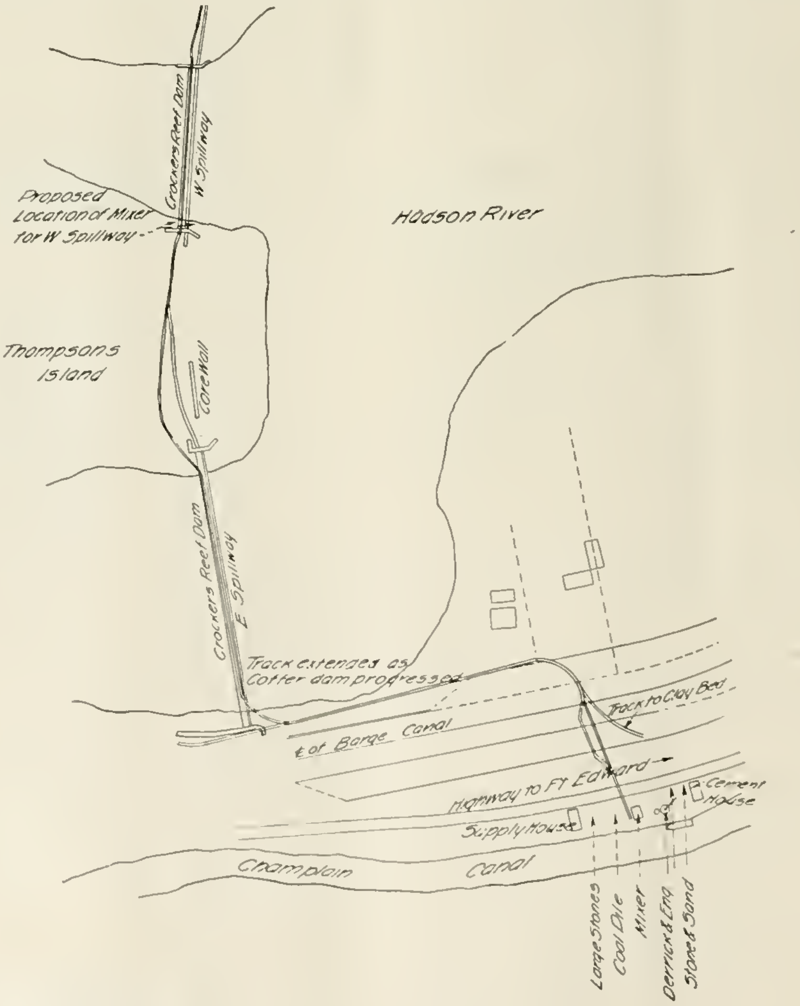
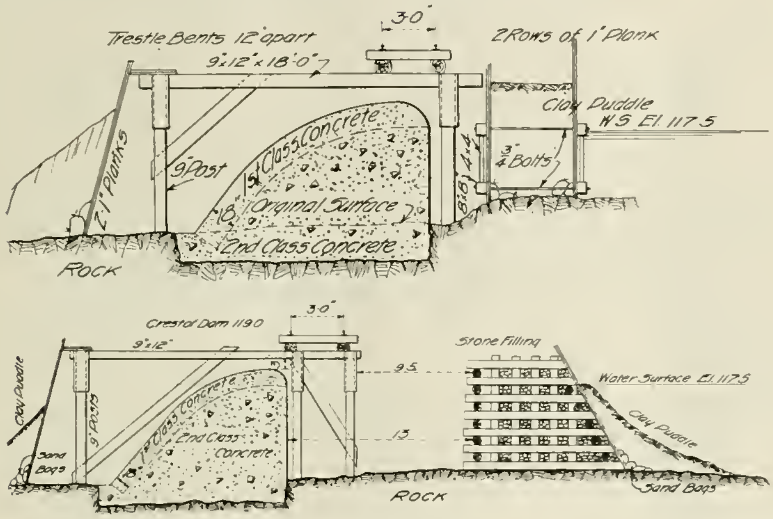


Fig. 2.—Plan of Crocker's Reef Dam Showing Layout of Construction Plant.

the point. But the spillway was completed the latter part of August, and water started flowing over it Sept. 1, 1906.

The west spillway, which was about 280 ft. wide, was closed by one section. Its coffer dam and the excavation started on Sept. 12. Concreting commenced Sept. 18, at 8:50 a. m. and on the morning of Oct. 6, 1906, water running over this spillway, marking the practical completion of all river work so far as the dam itself was concerned. The abutment and core walls for the dam were finished soon after, and about Nov. 22 everything had been built and the plant removed, except for a small quantity of embankment which was to be placed behind the abutment wall of the west spillway.

In all, about 3,550 cu. yds. of concrete were placed. This method of construction is typical of what will be used for most of the new dams to be built on the Barge Canal.



Figs. 3 and 4.—Details of Coffer Dams and Service Trestle, Crocker's Reef Dam.

Through the consolidation of several irrigation companies in Colorado, arrangements have been completed for the construction of a large dam at a point nine miles northwest of Denver. The dam will have a length of about 1¼ miles and a height of 150 ft. and will impound 5,000,000,000 cubic ft. of water. The dam and auxiliary systems thus far projected for collecting and distributing the water will cost upward of $4,000,000.

According to "English Mechanics," hardening an ordinary drill in sulphuric acid makes an edge that will cut tempered steel or facilitate cutting hard rock. The acid should be poured into a flat-bottomed vessel to a depth of about ⅛ in. The point of the drill is heated to a dull cherry red and dipped in the acid. This makes the point exceedingly hard, while the remainder remains soft. If the point breaks, reharden, a little less acid being used in the vessel.

Tunneling Operations in New York City and Vicinity.*

BY H. T. ILDAGE, NEW YORK, N. Y.

(Continued from page 6, July 3, 1907.)

Some portions of the North River tunnels of the Pennsylvania Railroad Co., the Morton street extension of the Hudson tunnel, the Pennsylvania Railroad Co.'s East River tunnels and the tunnels from the Battery to Brooklyn are being built in sand and gravel of various kinds, which permit the escape of air and inflow of water, and must consequently be dealt with in a special manner.

As has already been stated, with a full face of silt, no excavation is done. The shield is simply pushed ahead, and the silt removed is that which flows in through one or several doors. No work is done ahead of the shield.

With a full face of sand or gravel, almost all the material has to be excavated, and very little of it can be displaced, necessitating the maintenance of a vertical face ahead of the shield, either by poling boards or by other means.

When the face is part silt and part rock, the air pressure in the tunnel is generally lower than the pressure of the silt, and the poling boards, etc., are depended upon to exclude the silt. If there is a small leak of silt it does not matter.

When the face is part sand or gravel and part rock, the object aimed at is to make the air pressure balance the water pressure; and since the water pressure is greater at a lower point of the face than at a higher, it follows that over part of the face the air pressure is generally too great, and over the remainder too low. The difficulty is to prevent the excessive escape of air on the one hand, and the excessive inflow of ground on the other. In the case of very fine sands, such as occur extensively in the bed of the East River, excessive escape of air is accompanied by the removal of the material; the falling outwards or shrinking of the face, and ultimately by the opening up of a passage to the river, and the occurrence of a "blow." In the case of coarse sands and gravels, this latter difficulty (the removal of material) does not occur, but in this case the ground is so open that the escape of air is always excessive unless a very small portion of the face is exposed at one time. If (in fine sand) the air pressure were much lower than the water pressure, it would be impossible to prevent the inflow of fine sand, which, when saturated with water, is more mobile than the silt, and the polings would collapse.

It is evident that the adjustment of the air pressure in a tunnel passing through sand or gravel is much more delicate and difficult than in a tunnel passing through silt.

With regard to methods in the Morton street extension, and in those parts of the Pennsylvania tunnels that are in sand and gravel, the method of working was similar to that described for a face part silt and part rock, except that horizontal polings were used instead of vertical polings. The top board was advanced first and strutted to the shield, and then the second, and so on until the whole face was advanced, when "soldiers" were put against it and held by the sliding platforms and by struts that passed through the shield to the tunnel lining.

In the East River tunnels of the Pennsylvania Railroad Co. steel shutters were provided to be used instead of poling boards. These shutters consisted of steel plates stiffened with angles and provided with small doors, running in guides, which were attached to the compartment walls of the shield. They were controlled by long screws fixed to their ends and running through bearings attached to the compartment walls. The top shutter was intended to be advanced first, the material being raked out through small doors. Then the second one could be advanced, the material being removed through the space between the top one and the second one, and so on. This is the way in which a similar shield was used for the Blackwall tunnel, with excellent results.

In the East River work, the shutters have not, so far, been used in this way, but the face is poled with horizontal poling boards down to the level of the lower platform, the lower part of the shield being left practically full of sand. These polings are then held up with struts that will telescope under considerable pressure while the shield is advanced.

This is, in effect, the same method that was used in the North River tunnels.

To sum up, it is evident, that the method used of working a sand or gravel face consists of poling the face with horizontal polings, and then holding it independently while the shield is advanced. An attempt was made to use vertical polings in the North River tunnels, but was abandoned.

The method thus used was probably originally used in part of the Blackwall tunnel work, and with modifications was used in coarse gravel in the Baker street and Waterloo tunnels. It appears to be the best, if not the only satisfactory method of working with a face of sand or gravel.

At this point a brief description of the various types of shields that are being used may be of interest.

The shield for the north tunnel of the New York & Jersey Railroad Co. has been mentioned. It consisted of a steel shell or skin, 19 ft. 11 ins. in exterior diameter, 10 ft. 6 ins. long and 1.25 ins. thick, stiffened by the addition of an inner shell, 3 ft. 2 ins. long and 16 ft. 11 ins. in internal diameter, connected to it by radial webs. The compartments of this ring were utilized to hold the 16 hydraulic jacks used to propel the shield, utilizing the iron lining as an abutment. The interior, shut off from the tunnel by a diaphragm, was divided into nine pockets by two vertical partitions and two horizontal platforms, and these pockets were open to the face and were accessible from the tunnel through hinged doors.

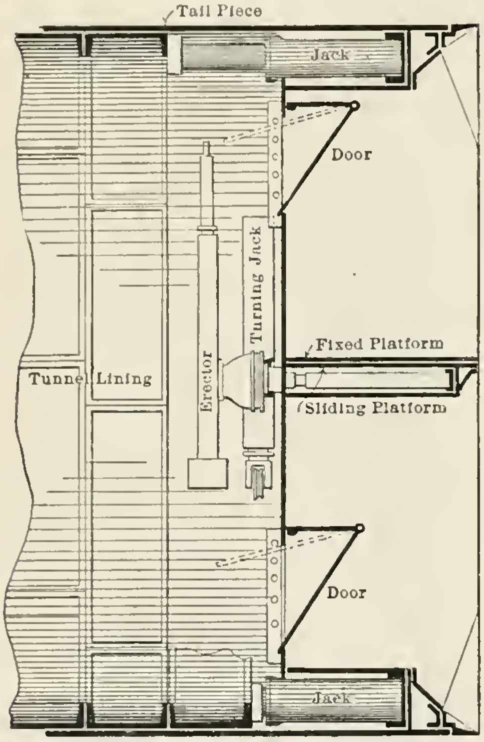


Fig. 5.—Shield for Hudson River South Tunnel.

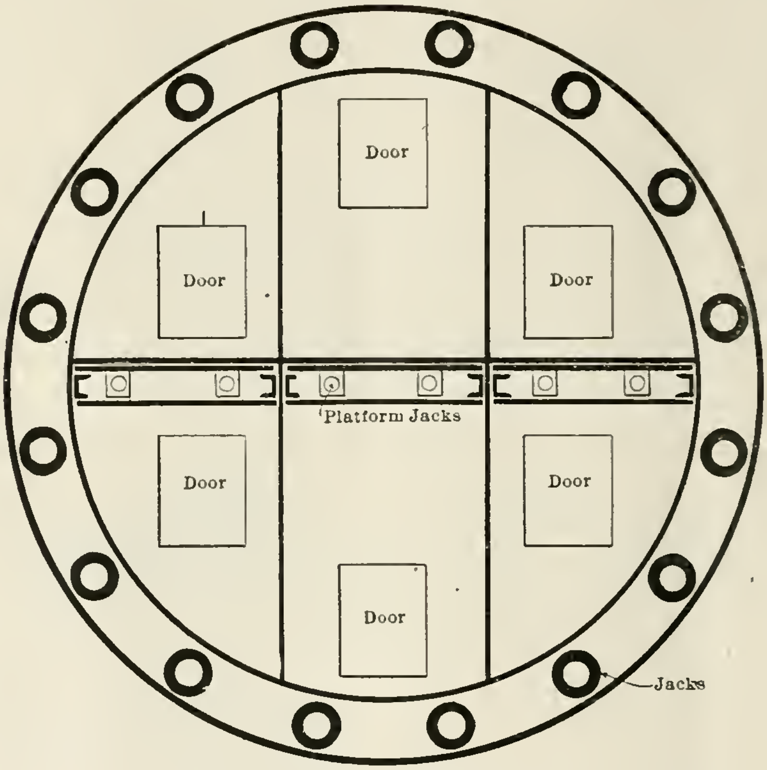


Fig. 6.—Transverse Section of Shield for Hudson River South Tunnel.

The south tunnel shield, Figs. 5 and 6, consisted of an outer skin, 16 ft. 9 ins. in internal diameter and 10 ft. long, with an inner shell of 14 ft. 9 ins. internal diameter and 3 ft. long. The space inside this shell was divided into six compartments, or pockets, by two vertical stiffening partitions and one horizontal platform. The face was closed with a diaphragm, which was provided with six doors that swung inwards on a pivot. A horizontal sliding platform in three parts was provided, each part being actuated by two hydraulic jacks.

The erector used for placing the lining in position, which was on the shield, consisted of a long arm carrying a hydraulic jack, which was caused to rotate about an axis coincident with the axis of the shield by two other hydraulic cylinders. The shield was driven by 16 hydraulic jacks, 8 ins. in diameter, suitable for use with a pressure of 5,000 lbs. per sq. in., giving a maximum pressure of 125 tons per jack, or 2,000 tons for the whole shield.

The shields that were used for the North River tunnels of the Pennsylvania Co., Figs. 7 and 8, had an external diameter of 23 ft. 6¼ ins.; the skin being made up of two 0.75 and one ⅝-in. plates, the internal diameter was 23 ft. 2 ins., allowing a clearance of 1 in. all around the 23 ft. tunnel lining. The total length of the shield was 15 ft. 11.5 ins., and the hood, which covered rather more than one-third of the circumference, extended 2 ft. 3⅜ ins. further. The length of the tail was 6 ft. 4.5 ins., being long enough to cover two and a half rings of the lining 30 ins. long. The forward part of the shield was divided into nine pockets by two vertical partitions and two horizontal platforms. Each of the platforms had a sliding extension made in four pieces, each piece being actuated by two hydraulic jacks.

The pockets were closed at the end nearest the face by plates covering about half the opening and inclined so that the upper edge of the plate was nearest the face. The remainder of the opening could be closed by means of a door. The doors were segments of a cylinder, and swung in pivots attached to the vertical diaphragms. A single erector was used, which being typical of the erectors used on the shields described is shown in Fig. 9. The shield was driven by 24 jacks, with rams of 8.5 ins. diameter. The maximum hydraulic pressure available was 5,000 lbs. per sq. in., and this gave, with all jacks, a total forward pressure of 3,300 tons.

The East River (Pennsylvania tunnels) shield, of which the leading features are shown in Figs. 10, 11, 12 and 13, is of very similar design to the one used for the Blackwall tunnel. It is 18 ft. long over all, and is provided with a hood that can be advanced and withdrawn at will. The face is closed by two diaphragms fitted with air locks, the object being to permit of a higher pressure of air being used in the face than in the tunnel.

The shield is fitted with two erectors, and the erection of the iron lining can go on at both sides of the tunnel at the same time. The erector arm in this case is revolved by a single cylinder, the ram being fitted with a rack which gears with the toothed hub, by which the revolving arm is mounted on its pivot. In the erectors on other shields mentioned there were two cylinders for turning the arm, and the transmission was either by cable or by chain. The face shutters with which this shield is fitted have already been briefly described. There are 27 jacks, with 9-in. diameter plungers, for shoving the shield, and they are capable of exerting a total forward pressure of 4,050 tons with 5,000 lbs. per sq. in. pressure. They are more closely spaced in the bottom than in the top. The reason for this arrangement has already been suggested; if the air pressure were so regulated as to balance the water pressure at the bottom of the shield, it would be about 10 lbs. per sq. in. in excess at the top, and "blows" would result; if it be less than sufficient, as in the case, the invert of the shield and tunnel is filled to a corresponding level with sand and water, and below this level the face cannot be poled. Additional power is therefore necessary to displace this material in the bottom when the shield is advanced.

A cross section of iron lining used on the Pennsylvania tunnels is shown on Fig. 14 as a type.

The shields, Figs. 15 and 16, that have been used in the Battery tunnel of the Rapid Transit Commission differ from others in several respects, the most important of which is, probably, the lack of provision for vertical protection of the face. The shield was provided with a fixed horizontal platform, and arrangements were made for other horizontal platforms to be made of poling boards, and on these the material was allowed to fall with its natural slope. The erector was mounted on a separate carriage that trailed along behind the shield. It was rotated by a small three-cylinder compressed air motor, and the hydraulic cylinder in the arm received power, as did the shield jacks, from a compressed air driven power pump mounted on the same carriage.

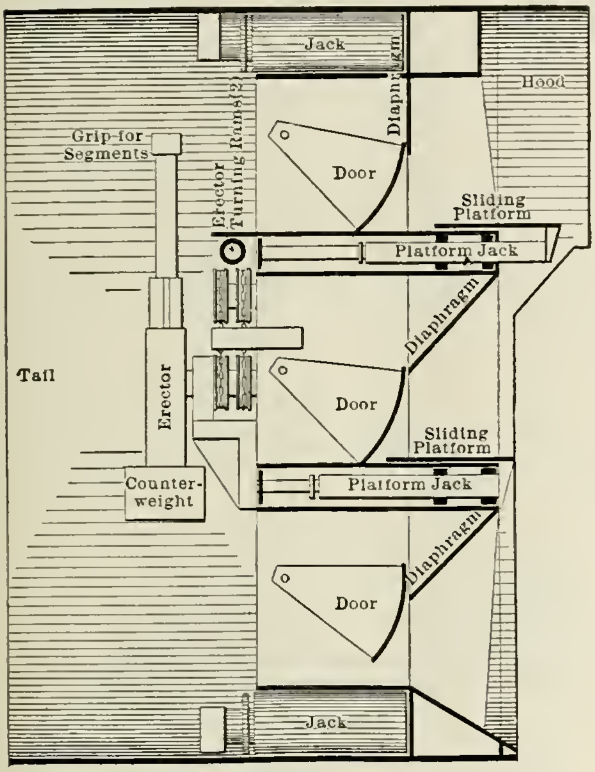


Fig. 7.—Longitudinal Section of Shield for North River Tunnels, Pennsylvania R. R.

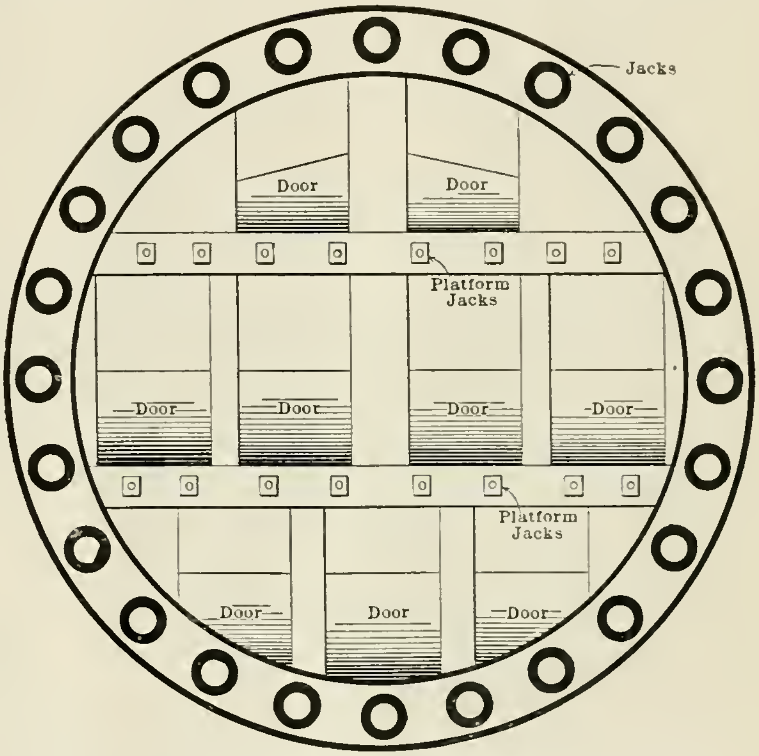


Fig. 8.—Transverse Section of Shield for North River Tunnels, Pennsylvania R. R.

The cost and the rate of driving tunnels through loose ground by the shield method vary very considerably, and are dependent upon a number of considerations. Of course, the most important is the nature of the ground. In a soft clay or silt, where it is sometimes possible to shove the shield ahead without removing through the tunnel any material whatever, the labor charges are very low.

In a sand or gravel fully charged with water where all the material has to be removed, and the face kept by polings, and especially where part of the face is rock, the cost is much higher. A higher air pressure has to be maintained, with consequent increase in the price of labor. The labor is not so efficient, the progress is very much less, and often it is quite irregular. For instance, in the Hudson tunnel at one time there were two faces at which work was proceeding, one of sand and the other of silt. The shields were alike and the tunnels the same size. The progress in the first was at one time not much more than 1 ft. per day, although this was afterwards increased to 6 or 7 ft. per day. In the second, the progress was at the rate of 50 ft. in 24 hours.

The cost of labor per day was probably about the same in each case, so that the labor cost per unit of strength was evidently very different in two cases.

The design of the shield is another matter that has very great influence on the progress made. Of necessity, every shield that has been used up to the present time has been more or less experimental, and many of them have had to be changed or added to in some respect or other during the course of the work. There seems to be no reason, however, with the lessons that have been learned under the North and East rivers, together with the experience that has been obtained before, why a shield should not be designed that would be suitable for any conditions that might arise during the progress of the work.

Such a shield would have a hood extending down over about two-thirds of the circumference, and forward about 4 ft. from the cutting edge. It would have strong and efficient sliding platforms. It would be provided with some means of supporting the face, so that the shield could be advanced without any change in the arrangement of the supporting pressure. The door space would be as large as could be obtained, and the openings would be fitted with doors that could be kept open or closed, as was required by the method of working and the nature of the material, and that were capable of being surely and quickly closed in an emergency. All the openings would be fitted with a removable siphon trap arrangement for the protection of the men and tunnel in the event of a "blow" in the face. As regards the propelling mechanism, the jacks should be provided with a good automatic "pull-back" that would avert the troublesome necessity of prying and wedging back the rams in order to erect the iron.

The labor question is one that has probably a greater effect on the cost of tunneling than is the case in other kinds of engineering work. The progress of a tunnel is peculiarly liable to interference caused by unskillful or unsympathetic work in the face. It has been necessary in every

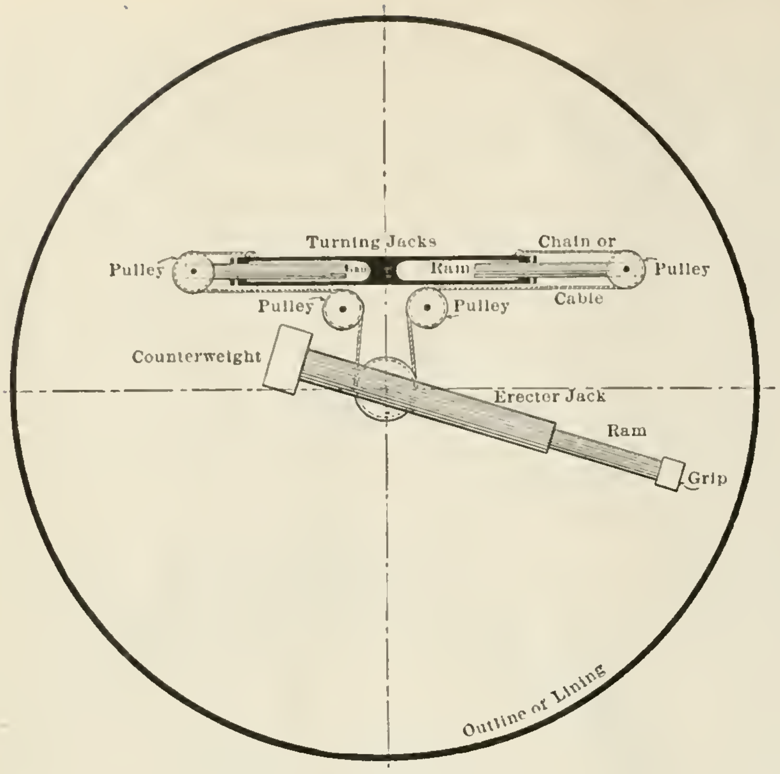


Fig. 9.—Erector for Iron Lining.

tunnel that has been built in New York to train the men in their work, and to produce from the rawest material more or less skilled tunnel builders. This has increased considerably the cost of supervision, and has added materially to the natural difficulties of the work. The task has not been at all simplified by the tendency to "unionize" the laborers and foremen, nor by the tendency of the sensational newspapers to magnify the "heroism" of the men.

The depth of the tunnel below the surface, in addition to increasing the cost of raising and lowering material, usually affects the air pressure it is necessary to use. An increase in the air pressure is accompanied by an increase in the daily rate of pay and by a dimension of the number of hours worked, and, since the work proceeds night and day, by an increase in the number of men employed.

The size of the tunnel has its effect on the efficiency of the work, but it is not possible here to make a full discussion of this point. It may perhaps be proper, however, to emphasize the somewhat obvious fact that the work will be more efficient in a tunnel where it is possible to work a great number of men in the face, conveniently, at one time.

The following figures, showing the approximate rates of progress attained in the various tunnels named, may be of interest:

Hudson River north tunnel (old Hudson tunnel): a brick tunnel in silt, 16 ft. wide by 17 ft. high internally, driven by pilot tunnel method at the rate of about 3 ft. per day. Iron lined shield driven continuation of above tunnel, 19 ft. 6 ins. external diameter, in silt, at the rate (exclusive of contingencies) of from 10 to 12 ft. per day; and part rock and part silt, from 1 ft. 8 in. to 3 ft. 4 ins. per day. From 18 to 20 men at work at the shield.

Hudson River south tunnel (16 ft. 7 ins. external diameter): an iron lined shield driven tunnel constructed through silt at

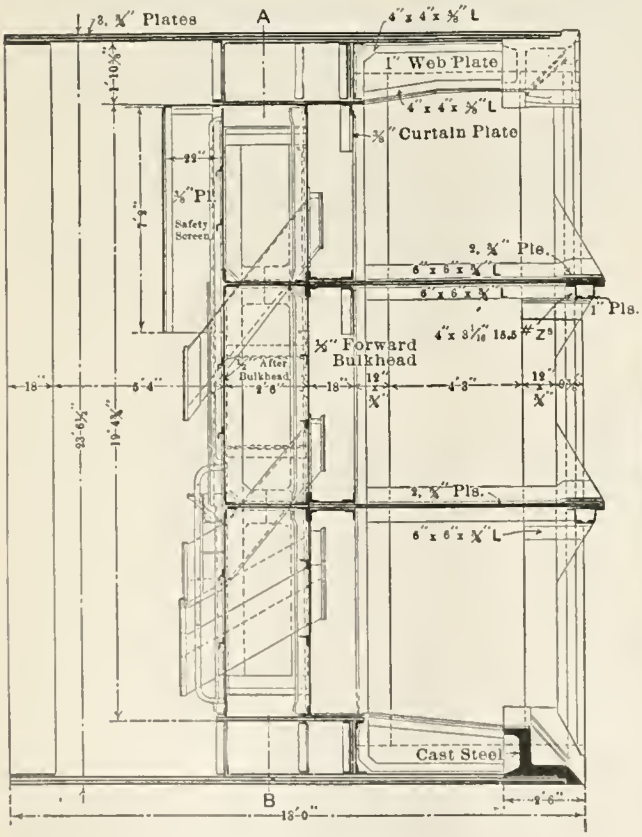


Fig. 10.—Longitudinal Section of Shield for East River Tunnels. Pennsylvania R. R.

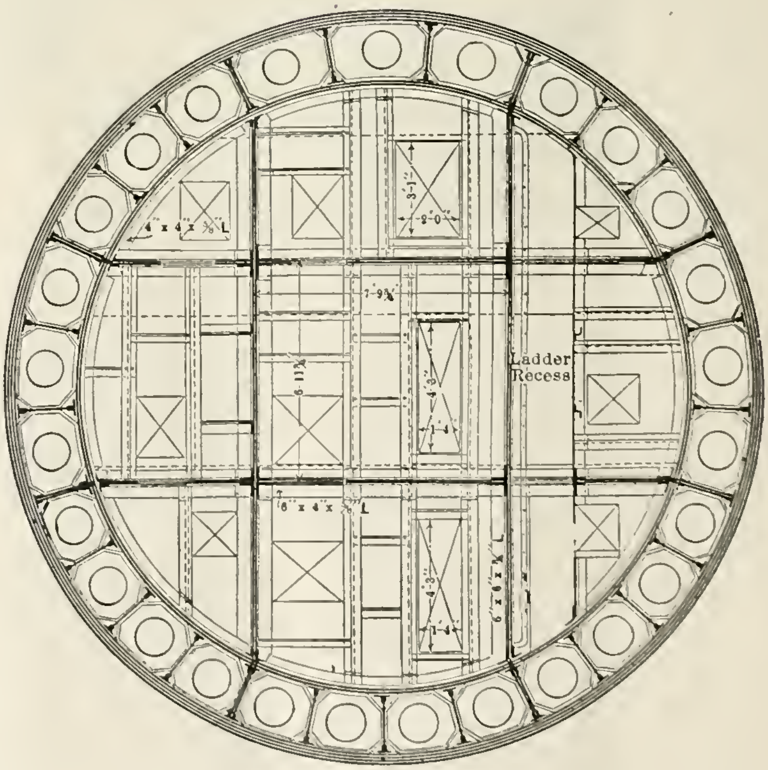


Fig. 11.—Section Through AB of Shield for East River Tunnels, Pennsylvania R. R.

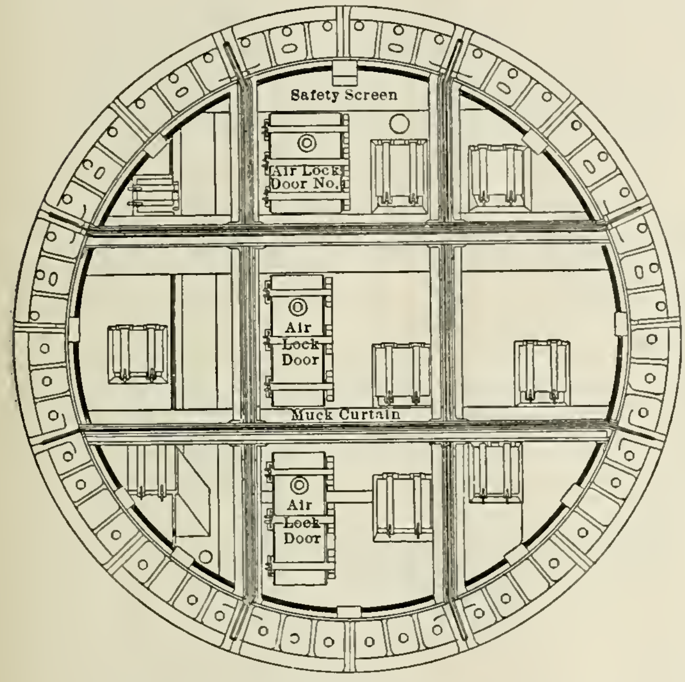
the rate (exclusive of contingencies and delays for the lack of iron lining) of about 50 ft. per day.

Morton street extension of Hudson tunnel: 16 ft. 7 ins. external diameter, in sand, driven at the rate of from 1 to 8 ft. per day. From 18 to 20 men at the shield.

Pennsylvania North River tunnels: 23 ft. external diameter, in rock, or face of part rock and part silt, from 2 to 3 ft. per day average; full face of silt under river, from 13 to 14 ft. per day average. About 30 men at the shield.

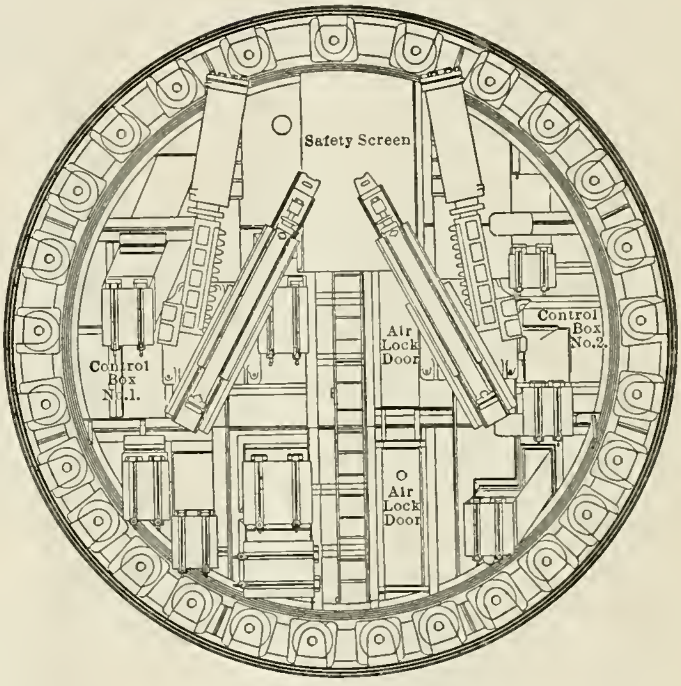
The Pennsylvania East River tunnels are still being driven. They are 23 ft. external diameter, and the progress has varied from a few inches to 12 ft. per day, according to the nature of the ground passed through.

Battery Tunnel of Rapid Transit Commission: 16.7 ft. external diameter, in sand, made maximum progress of 12 ft. per day. About 10 men at the shield.



FRONT VIEW

Fig. 12.—Shield for East River Tunnels, Pennsylvania R. R.



REAR VIEW

Fig. 13.—Shield for East River Tunnels, Pennsylvania R. R.

The rate of pay for tunnel-laborers in compressed-air is from $3 to $4 per day of from 8 hours in pressures below 32 lbs. to 6 hours in higher pressures. These figures are, of course, approximate, being dependent upon varying conditions encountered.

The work here described is distinguished from ordinary mining work by the fact that it is carried on with the aid of compressed air, which assists to prevent the inflow of the fluid or semi-fluid earth. A bulkhead is built in the tunnel or shaft, separating the face of the work from the outside air and forming a chamber into which air is pumped at the necessary pressure. Access to this chamber is obtained through air-locks which are usually steel cylinders fitted with air-tight doors opening towards the face and with pipes and valves, by means of which the pressure inside the locks can be varied at will from normal pressure to the pressure inside the chamber.

The pressure inside the chamber is dependent upon the depth of the tunnel below the surface of the ground, being in the case of silt equal to or less than the head of silt and water above the tunnel, and in the case of sand or gravel equal to the head of water a few feet above the invert of the tunnel.

The quantity of air necessary, and consequently the capacity of the compressor-plant, depends, in the case of a tunnel in silt or other air-tight material, upon the number of men working in the tunnel, the object being to give efficient ventilation everywhere, and to maintain the air of such purity that analyses do not show the presence of more than 0.1 per cent of carbon dioxide. This may take as much as 100 cu. ft. of free air per man per minute. In the case of sand, gravel, or other open ground, sufficient air is required to replace that which escapes through the face, and the amount depends upon the closeness of the ground and the manner in which the face is worked.

The effect of compressed-air on the health of men is a matter for doctors rather than engineers; experience has shown that work can be carried out without risk to life or injury to health in pressures up to 35 lbs. per sq. in., provided certain precautions are taken. These are (*a*), the exclusion of men not in good physical condition, especially when suffering from heart or lung troubles or catarrhal affection of the head; (*b*), efficient ventilation of the tunnel, particularly where men are at work; (*c*), provision of warm clothing and warm quarters for the men on leaving the tunnel, and, in general, the avoidance of chills; (*d*), the careful observance by the men of all the ordinary rules of health.

There is one method of tunneling that has been tried experimentally, and is worthy of mention—viz., the "freezing" process. This process, which has been successfully used many times in shaft-sinking, has never been applied to driving a long tunnel. It was used successfully in passing through a short length of bad ground in the Stockholm tunnel, and is now being tried in a tunnel in Paris. The problem of tunneling by freezing is essentially different from shaft-sinking by freezing. The face is vertical instead of horizontal, and the length is great and indefinite. In the case of a shaft the freezing-pipes can be sunk outside the excavation and all efforts concentrated in freezing an impervious wall about the ground to be excavated. In the case of a tunnel, it is almost unavoidable that the freezing should take place from the center, and in consequence the ground that is frozen the hardest and is strongest is the ground that has to be excavated, and would perhaps have been better if soft. The weakest part of the frozen mass is the wall outside the excavation—the part where strength is most necessary.

Among the contractors' proposals to construct the East River tunnels of the Pennsylvania Railroad Company was one to drive them by the freezing-process, and the method suggested was first to drive a small pilot-tunnel by any ordinary method, and then from that to freeze the ground out to such a distance that when the larger tunnel was excavated a sufficient thickness of frozen material would remain to resist the pressures of the water and the unfrozen ground beyond. The Pennsylvania R. R. Co. thereupon, with characteristic enterprise and forethought, made an experiment in tunneling by the freezing-process at considerable cost.

A shaft was sunk to a depth of about 85 ft. through the East 35th St. pier, and a tunnel 7 ft. 6 ins. in diameter was driven out a distance of 165 ft. by means of a small shield of compressed air. A number of pipes were attached to this lining with their axis parallel to the axis of the tunnel, and brine at a temperature of about 35 degrees below zero, Fahrenheit, was circulated through them for several months. Careful observations were made of the temperature of the ground surrounding the pilot-tunnel and of the quantities of heat extracted by the brine, and the laboratory determinations on a large scale were made of the thermal conductivities of different kinds of sand and gravel. The object of the experiment was not merely to test the feasibility of constructing a large tunnel by the freezing-process, but to collect, in addition, such information as would enable reliable estimates to be made of time and cost of driving tunnels of various diameters in different kinds of water-bearing ground by the freezing-process. The information that has been obtained is very complete, and as general in nature as it could be made.

After carefully watching this test, and studying the results obtained, I am of the opinion that freezing may be made a very valuable auxiliary to tunneling in water-bearing sands and gravels. It will not, as expected by some, supersede the shield and compressed-air methods, nor will it, in all cases, avert the necessity for the use of compressed-air; but it will, if intelligently applied, eliminate many of the uncertainties and difficulties of the methods now in use. Figs. 17 and 18 are views of the pilot-tunnel during the test.

Tunnels in Construction (Fig. 1).—New York & Jersey Railroad Co.'s tunnels: Of the tunnels at present under construction, the first to be commenced was the old Hudson tunnel. This work was commenced in 1879 by D. C. Haskin, who sunk a shaft at the foot of Fifteenth St., Jersey City, and drove about 1,542 ft. of the north tunnel and 600 ft. of the south tunnel, chiefly by the pilot-tunnel method above described. A shaft was also sunk on West St., at the foot of Morton St., on the New York side, and a short length of the north tunnel was driven towards the Jersey shore. In 1882 the work was temporarily abandoned, to be taken up again in 1890 by S. Pearson & Son, who continued work in the north tunnel from Jersey City by the same method that Haskin used until perhaps 100 ft. had been driven. A shield was then built and an iron-lined tunnel constructed of 1,900 ft. in length, making the total length of the tunnel about 4,000 ft. by August, 1891. At this time, the funds being exhausted, the work was abandoned.

The undertaking was resumed by the New York & Jersey R. R. Co., with Mr. William McAdoo, as president and Mr. Chas. M. Jacobs as chief engineer, in 1901, and now forms part of an extensive system. This consists of twin tunnels from the station of the Delaware, Lackawanna & Western R. R. Co. in Hoboken, past the Erie R. R. station and the Pennsylvania R. R. station to the Jersey City terminal of the Central R. R. of New Jersey. These tunnels are connected with the New York side by the Hudson & Manhattan R.R. twin tunnels running from the Pennsylvania R. R. terminal to Cortlandt St., where a large terminal is being built; and by the twin tunnels (the original Hudson tunnel) running from the foot of Fifteenth St., Jersey City, to the foot of Morton St., and thence up Sixth Ave. to 33d St., where a terminal will be built. The total length of single track tunnel in this system is about twelve miles.

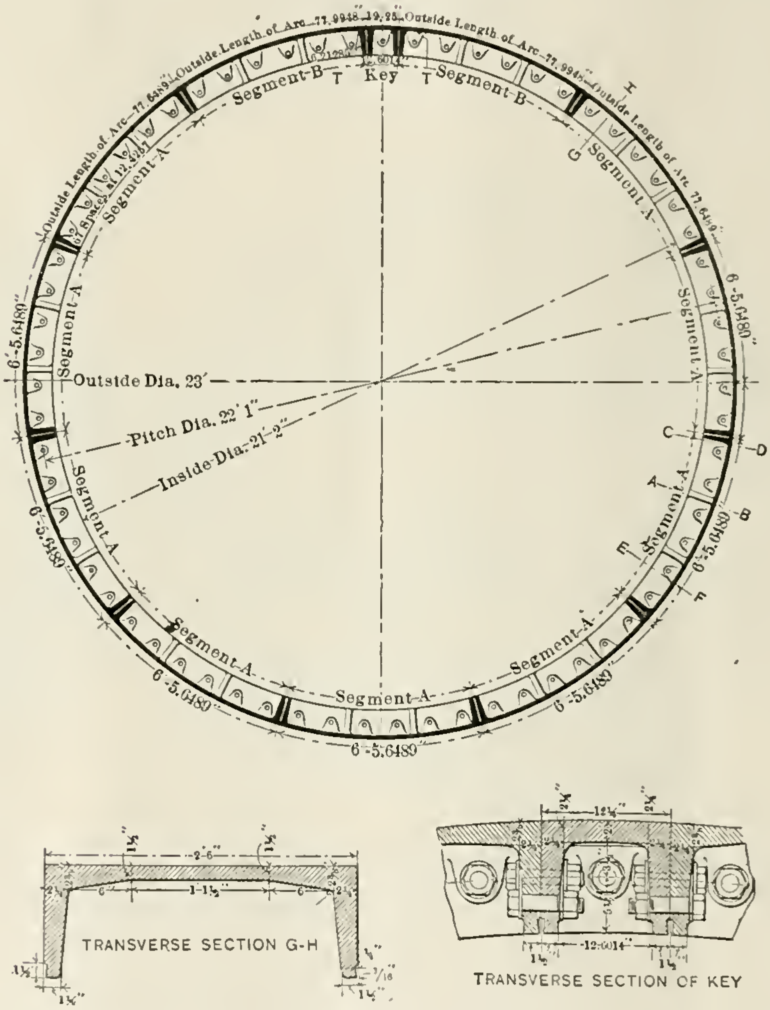


Fig. 14.—Type Section of Iron Lining.

The tunnels of the Pennsylvania R. R. Co. were commenced during the administration of the late A. J. Cassatt, with Mr. Samuel Rea in charge, and are being constructed under the general supervision of a board of engineers appointed by the late Mr. Cassatt, with General Raymond as chairman, and with Mr. Alfred Noble and Mr. Charles M. Jacobs as chief engineers of the East and North River divisions, respectively. There are two tunnels, 25 ft. 10 ins. wide and 21 ft. 5 ins. high, which start from the portal at the west side of Bergen Hill on the Hackensack meadows through the hill to a point 224 ft. east of the Weehawken shaft. For the most part these tunnels are in trap rock and driven by ordinary methods, but the contact of the trap and the sandstone occurring in the shaft at Weehawken, the rock just east of the Weehawken shaft is mixed in character. From the shield-chamber, 224 ft. east of the Weehawken shaft, the tunnel is first in rock, then in rock overlain by sand and gravel, then sand and gravel, and then silt, which extends across the whole width of the river. The tunnels were driven by shield and compressed-air methods, as described before. While passing through the sand and gravel it was found necessary to drive one tunnel at a time, the other being used to drain the ground somewhat. On

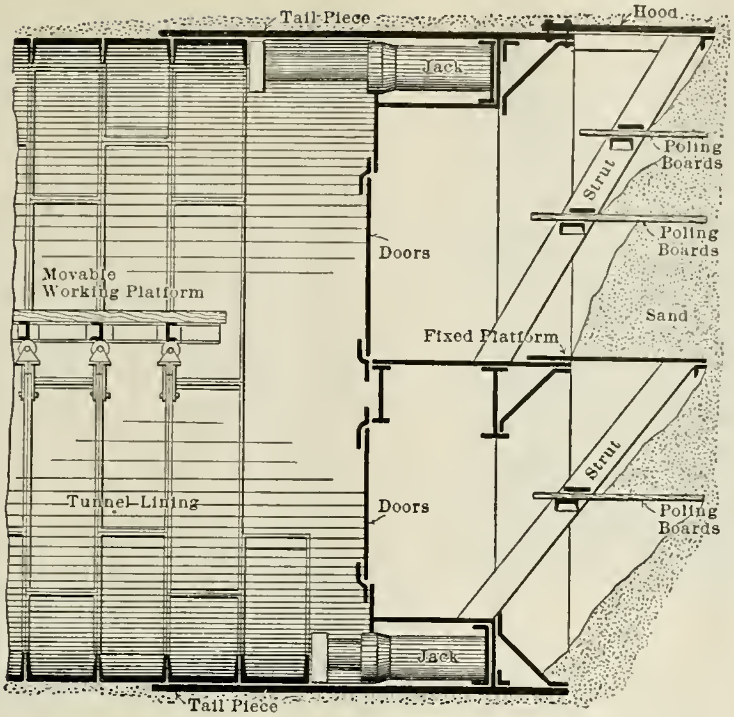


Fig. 15.—Longitudinal Section of Shield for Battery Tunnel.

the New York side the rock-level rises again, and the tunnel, from being entirely in silt, is entirely in rock, and the iron-lined tunnels end at a point about 1,070 ft. east of the bulkhead. Where the iron-lined tunnel was entirely in rock, it was driven ahead of the shield, and a concrete cradle laid to receive the iron lining which was erected behind the shield as it advanced.

From the shield-chamber to the east are twin tunnels that extend to the terminal station, which pass through rock varying in character from mica schist to hard trap, and overlain by sand and gravel. Where wholly in rock with good rock-cover, these tunnels are being excavated by ordinary rock-tunneling methods; where partly in rock and partly in gravel, they are excavated by cut-and-cover methods. From the terminal station eastward run two three-track tunnels, one under 32d and one under 33d St. Just west of Fifth Ave. the construction is changed to two pairs of single-track tunnels, which run into the shafts near First Ave. These tunnels are chiefly in rock, but there are short lengths where the rock cover is very thin, and in places it runs out altogether and there is part of a face of sand and gravel. The construction is again changed at the shafts near First Ave., where four iron-lined river-tunnels start and pass through rock, rock and sand and gravel, into a full face of quicksand, thence through a roof of rock into sand again, then back into rock and through the river-shaft in Long Island City for about 2,000 ft. to East Ave. From East Ave. to Thompson Ave. the work is either cut-and-cover or open cut. The total length of single tunnel in this system is about 18 miles.

With reference to the material through which these tunnels have been or are being driven, the prevailing materials forming the beds of the North and East rivers, while apparently quite different, have one or two points of striking similarity. They are composed of extremely fine particles, and both in their natural states contain surprisingly large percentages of water.

The silt of the North River resembles a soft clay, and contains at the level of the tunnels about 33 per cent by weight of water, which is considerably more than sufficient to fill the voids, if the particles were spheres. It is almost impervious to air and water, and flows freely under pressure. It apparently will not stand at any angle.

The chief material found in the East River is an extremely fine red sand, divided by occasional horizontal streaks of stiff red clay. It contains about 22 per cent by weight of water and is a typical quicksand. Under the action of a sufficient pressure of compressed-air, the water is expelled from it and it will stand vertically or even overhanging, and when in this condition it resembles a rotten sandstone. It permits the escape of compressed-air, though not at first freely, and when the pressure of air falls below the balancing-pressure it becomes quite liquid.

At one time it was thought that the tunnels under the North River would have to be supported against downward displacement, which it was supposed the vibrations caused by traffic might cause. A very careful investigation of the whole matter was made by General Raymond, who studied all the reliable evidence obtainable from the old Hudson tunnel and from the Pennsylvania tunnels, and made a long series of observations of the pressure exerted on the tunnels in both cases by the silt by means of a specially constructed pressure-gauge. He points out that, provided it be made tight against water and silt, it is not possible for a tunnel that is lighter than the displaced material to settle, and that the tunnels of the Pennsylvania Co., which, while normally lighter than the silt, may, when a train passes through, be momentarily heavier, will have to be held against

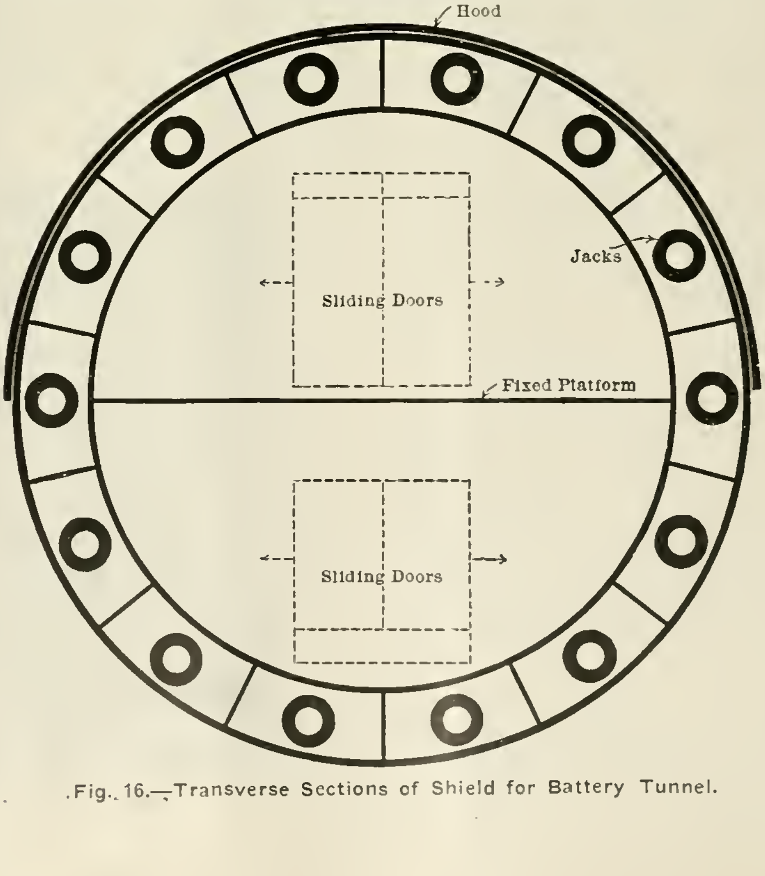


Fig. 16.—Transverse Sections of Shield for Battery Tunnel.

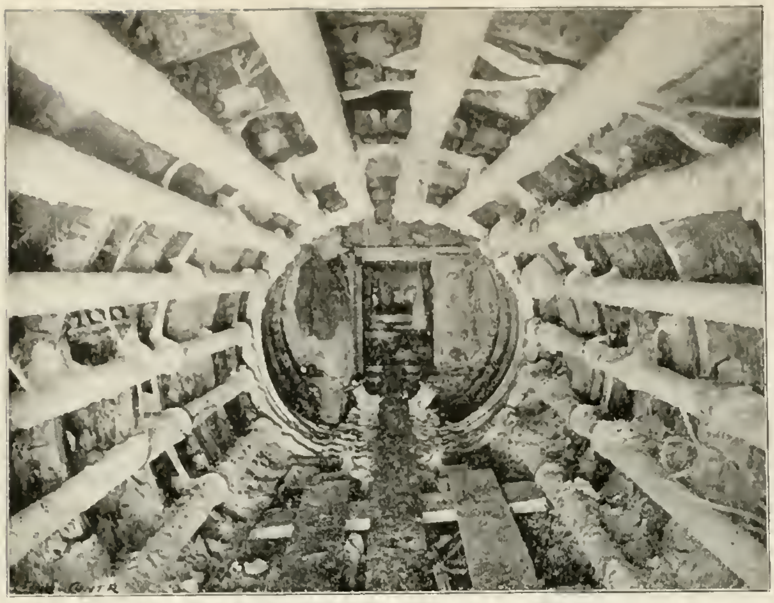


Fig. 17.—View of Brine Pipes in Pilot Tunnel.

both upward and downward motion, in order that they might be perfectly safe under all conditions, and that the only effect, if any, of vibrations, will be to tend to cause the tunnel to move in the direction of the resultant of the pressures which, in general, is upwards.

The tunnels of the Rapid Transit Commission, now under construction, consist of iron-lined twin tunnels in continuation of the Subway, from the Battery under the river to Joralemon St., Brooklyn, thence to a connection with the Fulton St. line, Brooklyn. The ground passed through, on the Manhattan side, was rock of a variable kind, some hard, and some soft and decomposed with irregularities and fissures; the roof of the excavation was timbered, and the iron lining was erected by means of an erector that traveled on rollers attached to the lining, the space between the rock and the lining being packed with dry rock and grouted; from this rock the tunnel ran into sand and gravel and then again into rock; on the Brooklyn side the work was entirely in sand and gravel and carried on entirely with shields.

The tunnels of the New York & Long Island R. R. Co. are twin iron-lined tunnels of about 15 ft. 3 ins. diameter driven in rock from 42d St. to Man-o-war's Reet and thence partly in sand to Long Island City. From New York to Man-o-war's Reef it is expected to avoid compressed-air work, as the tunnel is entirely in rock, but fissures occur in the rock and compressed-air has been used to some extent.

All the tunnels above mentioned are under construction at present, and make a total of 38 miles of underground workings.

In addition to these works under construction it may be mentioned that about 66 miles of new subways are projected, and most of them must be constructed in the near future.

As regards the illustrations of this paper, I am grateful for permission to reproduce Fig. 2 from a paper by Mr. William Sooysmith entitled the Hudson River Tunnel,* and Figs. 10, 11, 12 and 13 from the working-drawings of Messrs. S. Pearson & Son, contractors for the East River tunnels of the Pennsylvania Railroad Co., and the photographs from the collection of the Pennsylvania, New York and Long Island Railroad Co.

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*Transactions of the American Society of Civil Engineers, vol. xi., pp. 314 to 323 (1882).

During the half year ended Sept. 30 last there were 2,290 automobile accidents in Germany, of which 673 caused injury to persons. The number of persons killed and wounded amounted to 1,570, including 51 killed. Of the latter 9 were chauffeurs, 9 passengers of the automobiles and 33 other persons.

Wages of labor and prices of materials and supplies in the Klondike are given as follows by U. S. Consul G. C. Cole of Dawson:

Wages.	
Mechanics, per 10-hour day	$10.00
Common laborers with board	$4 to 5
Without board	$6
Two-horse teams, per day	$25
Clerks per month	$150 to $300
Fuel and Lumber.	
Coal, native, per ton	$15.00 to 20.00
Wood, per cord	12.00 to 15.00
Spruce, native undressed, per M	45.00
Fir, imported undressed, per M	125.00
Oak, imported undressed, per M	400.00
Foodstuffs.	
Oats, per ton	$80.00 to 120.00
Hay, native, per ton	60.00 to 80.00
Hay, imported, per ton	80.00 to 120.00
Beef, per pound	.25 to .50
Pork, per pound	.40 to .50
Ham, per pound	.35
Bacon, per pound	.35
Turkey, per pound	.50
Chicken, per pound	.50
Cheese, per pound	.40
Butter, per pound	.50
Lard, per pound	.20
Tea, per pound	.50 to .75
Coffee, per pound	.35 to .65
Rice, per pound	.08 to .10
Flour, per hundred	6.00
Potatoes, per hundred	8.00 to 14.00
Eggs, domestic, per dozen	2.00
Eggs, imported, per dozen	1.00
Milk, per quart	.35
Milk, canned, per case of 4 dozen	7.50
Canned vegetables, per case	4.00 to 8.50
Canned fruits, per case	6.00 to 8.50
Oranges, per box	12.50 to 25.00
Apples, per box	4.00 to 6.50
Boarding.	
Hotels, per day	$3.00 to 6.00
Restaurants, per meal	0.70 to 3.00
Board and room, per month	90 to 150
Horses.	
Cost of draft horses per span	$1,000 to 1,800
Boarding horses per month	60 to 100

The total quantity of Portland cement manufactured in Canada during 1906 was estimated at 2,152,562 barrels, compared with 1,541,567 barrels in 1905. Fifteen companies were operating plants in Canada during the year. The average price per barrel was $1.49, compared with $1.42 in 1905. The Canadian cement importations last year amounted to 604,503 barrels.

The Italion Government has appropriated $600,000 for the construction of a floating dock at Taranto.

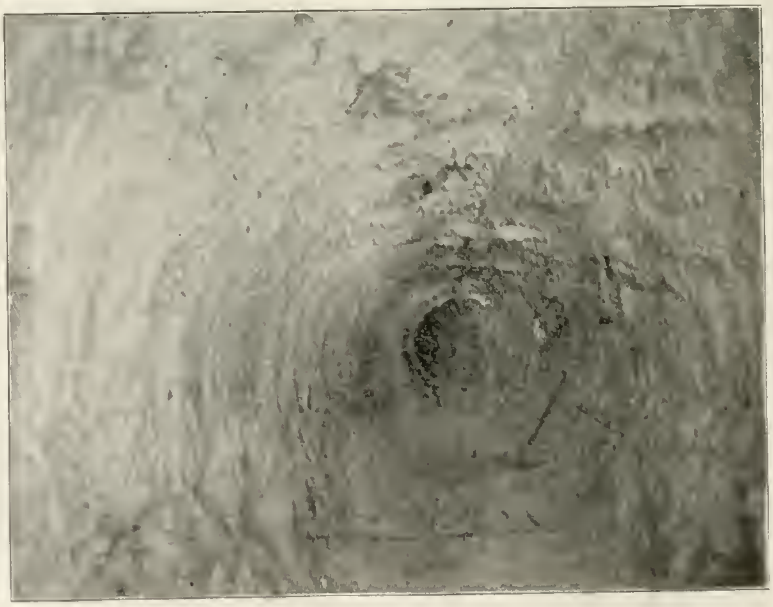


Fig. 18.—View of Pilot Tunnel During Refrigeration

Methods and Costs; Some Old; Some New

Tunnel Work.—The construction of a tunnel offered some difficulties owing to the fact that the grade line necessitated the driving of the upper portion of the bore through soft gumbo clay, while the lower portion was driven through solid rock, 6 to 7 ft. above grade. As the clay caved easily and had to be supported by heavy timbers, the contractors feared to blast out the rock by the ordinary methods. Accordingly a channeling machine operated by compressed air was used to free the side walls. This channeler left a shoulder at the surface of the rock, on which the roof timbering rested. The desired depth was usually reached in two cuts and the rock was then drilled and blasted in the usual manner.

Crossing Sink Holes.—In the construction of a railroad a number of sink holes were encountered. These holes, while presenting on the surface the appearance of ordinary ground, would, when any bridge or bank was placed upon them, give way. One of these holes was particularly bad, and many trainloads of earth were dumped in without any apparent effect. This particular hole was finally crossed by making a large timber mattress, laying logs in the form of a grillage, and wiring the brush in and around them. Another of these holes only gave trouble after trains had been running over it for a year. A settlement, gradual at first, but increasing, swallowed a bridge and a section of track beyond recovery. After putting a large amount of earth and rock into the hole, a foundation was finally secured by dumping in many trainloads of sand enclosed in burlap sacks.

Running Lead Joint in a Partly Submerged Pipe.—The following method was employed in running a lead joint where the pipe was partly submerged. The pipe in question was laid under one of the main timbers of a bridge and it was impossible to raise it more than one-half of its diameter out of the water. After the pipe had been raised as far as possible the joint was yarned in the usual manner. As a clay roll would not stick in the water and as an asbestos roll was not available, a piece of twisted hemp packing was used instead. The upper side above the water line was pieced out with clay with the usual pouring hole on top. On one side, just above the water line, an extra vent was made. Before pouring the lead a small quantity of oil was placed in the upper opening and the lead was then poured in the usual manner. The oil prevented the hot lead from coming in contact with the water, and as the lead was poured it forced the oil down, which in turn forced the water out of the vent on the side of the pipe. The result was very satisfactory, the joint being left well filled and ready for calking.

Data on Ditch Work.—The following figures on ditch construction in Minnesota were given by Mr. George A. Ralph, State Drainage Engineer, in a paper before the Minnesota Surveyors' and Engineers' Society. The figures are the average prices and are based on contract prices for work on which Mr. Ralph was engineer; they cover a period extending from 1886 to 1906:

	Per cu. yd.
Slip scraper work:	
Not exceeding 6 ft. in depth	$0.10
Not exceeding 10 ft. in depth	.12
Not exceeding 12 ft. in depth	.14
New Era grader work	.08
Shovel work, 2 to 6 ft. deep	.15
Shovel work, 2 to 10 ft. deep	.20
Hayknife work, 2 to 4 ft. deep	.12
Hand labor in timbered swamps	.15 to .20
Good dredge work	.08
Dredge work, unfavorable conditions	.10 to .14
Capstan ditch, plow work	.40 to .60

Embankment and Jetty Construction.—The following methods were used in constructing embankment and jetties in the Eel River Improvement Work, California: The jetties were constructed by driving two rows of piles 12 ft. apart, with 12 ft. spacing; then filling in a layer of brush 35 ft. wide on the base and 5 ft. thick. Upon this was deposited a foot of gravel—the whole brush being securely wired to the piling, and again a layer of brush 4 ft. thick and about 27 ft. wide. Gravel was used to weight down this second layer, and upon it was placed concrete blocks varying in size from 8 to 20 cu. ft. Through these blocks run three strands of barbed wire, connecting the blocks and piles together. This plan gives very substantial results against a river that runs, when at its high stage, 12 miles per hour, and is about 30 ft. deep, and one-half mile wide. The revetment work was done as follows: Beginning with the almost vertical banks, they were sloped back to about 30 degrees from the water's edge. Then every 25 ft. along the water piles were driven, although concrete was preferable but not obtainable at the time, and between them were stretched five strands of barbed wire. On the top of the bank concrete blocks were similarly set, with four strands of barbed wire connecting them. To these two lengths of wire were stretched, two strands every 4 ft. up and down, along the bank. Every 8 ft. was attached wire for lacing, after the brush had been laid, when two top wires were drawn over the 24 ins. of brush and drawn down by the lacing, thereby creating a mattress. The brush was composed of at least 40 per cent willow and was weighted with 6 ins. of gravel to hold it and give opportunity for growth.

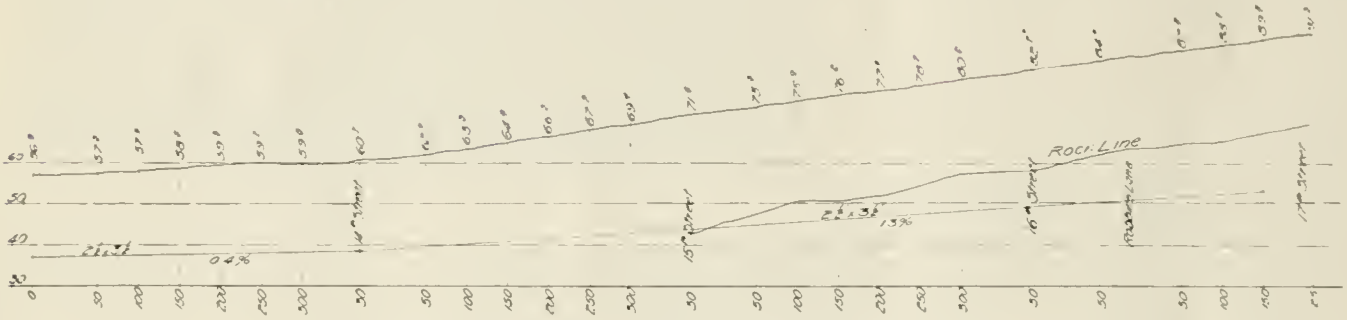
Repairing Submerged Pipe Line.—A 12-in. cast iron main laid on the natural bed of a river without trenching, at an average depth of 8 ft. of water, was broken by an ice jam. One of the lengths of pipe was broken in the joint and the broken pipe line was carried down stream until the ruptured ends were about 15 ft. apart. The method of repairing the pipe line pursued by Mr. Harry A. Lord, Superintendent of Waterworks, of Ogdensburg, N. Y., was as follows: The shore ends of pipe line, which were 350 ft. long, were uncovered and made as free as possible from gravel or other material which might hinder it from being drawn ashore. The pipe was disconnected at the western end, where the ground was low and flat, and a heavy capstan operated by horses was anchored and made fast to the pipe by block and cable tackle. The pipe line once started came freely, each length being melted free with kerosene oil heaters, and disconnected as it came ashore. After the westerly section had been taken from the water, a diver attached a 1½-in. cable to the broken end of the easterly portion of the pipe line. This portion of the pipe line was jammed on a ledge of rock and a scow and pipe derrick were necessary to raise it onto the ledge. Once there, however, there was no difficulty in hauling the easterly half of the pipe line across to the west side of the river and disconnecting it. The disconnected lengths were then carted to the high ground on the easterly side of the river, cleaned, coated with water proof metallic paint and made ready to put together again. In doing this a tight wooden plug was fitted into the leading bell to keep out gravel and other debris; a heavy wrought iron band was bolted back of the bell, and to this band were welded heavy iron drawbars, meeting in front of the center of the bell in a clevis to which was attached the cable reaching across to the capstan on the west shore. As soon as a joint was poured and caulked, the pipe was hauled into the water by means of the cable, and in this manner the pipe was again made continuous and upon testing was found to be tight.

In the Panhandle of Texas it is usually estimated that the cost of sinking a well and installing a windmill, pump and tanks averages about $2 per foot for deep wells and a relatively larger sum for shallower ones. Wells 400 to 500 ft., including mill, pump and tanks complete, cost from $800 to $1,000, while if the well is but 100 ft. deep the cost is $250 to $300.

The total excavations from the Panama canal during June, according to a report from Chief Engineer Lieutenant-Colonel Goethals, was 780,957 yards.

Cost Data on the Construction of a Brick Sewer, Including Cost of Excavation by Tunneling.

The 13th St. sewer in St. Louis, Mo., for construction of which data are given below was designed to give deep drainage in a down town district, where the street is narrow, the traffic heavy, and the ground well filled with pipes and conduits. Owing to these conditions, the plans were made and contract let for tunneling the entire sewer. The sewer is brick, 30-in. x 42-in. diameter and 1,458 ft. in length.



Profile of Thirteenth Street Sewer, St. Louis, Mo.

Rock was struck approximately close to that shown in the profile. Taking a mean length of earth and rock, there were 630 ft. of earth and 828 ft. of solid rock tunnel. Five shafts were used in the earth section and ten in the rock.

The work was done by the Myers Construction Co. of St. Louis during the winter of 1906-1907, in 190 days, including Sundays and holidays.

The contract included the excavation of 1,156 cu. yds. of earth and 880 cu. yds. of rock, and the construction of 770 cu. yds. of brick masonry. The work was paid for on the unit basis and all work done was measured up and paid for.

The earth was a plastic clay, which would drop out in the arch following the shovel. In this way extra work over the arch (over and above the regular 9-in. brick work) averaged 8 ins. In the rock tunnel, the average was 7 ins. over the arch and 6 ins. on the lower quarter haunches of the invert. These spaces were filled solid with brick masonry

In the earth section, a small opening was driven 4 ft. to 6 ft. in length, and braced with a crown plank and short upright supports. As this was enlarged, other crown planks were inserted, replacing the shorter supports with longer ones. The masonry was then built in the section, removing the timber supports as the masonry progressed. Material for the next section was passed through the finished one.

The rock was a stratified limestone, irregular and knarly. It varied in hardness, in some places to a flinty appearance. The blasting was done in batteries of three shots, the first in the upper, or arch, portion of the heading. When this broken rock had been removed, the same process was repeated on the lower, or invert, section. Holes were driven to a depth of about 2 ft. and loaded with from ¾ to 1½ sticks of 50 per cent dynamite, the size of stick depending upon the indicated hardness and position of the rock.

The cost of the work was as follows:

Earth excavation:	Per cu. yd.
Foreman, 520 hrs. at $0.50	$0.225
Bottommen, 1,320 hrs. at $0.50	.571
Laborers, 7,500 hrs. at $0.30	1.946
Carpenter, 830 hrs. at $0.50	.359
Labor, timbering, 620 hrs. at $0.30	.161
Timber, 22 M. ft. at $20	.381
Watchman, 520 hrs. at .017½	.079
Waste, 585 loads at $1	.506
Total	$4.228

The earth excavation amounted to 1,156 cu. yds. and each laborer averaged .154 cu. yd. per hour.

Rock excavation:	Per cu. yd.
Foreman, 1,000 hrs. at $0.50	$0.568
Bottommen, 2,600 hrs. at $0.50	1.477
Laborers, 9,980 hrs. at $0.30	3.402
Engineer, 1,600 hrs. at $0.50	.909
Blacksmith	.070
Watchman, 1,600 hrs. at $0.17½	.318
Dynamite, 4,000 lbs. at $0.15	.682
Caps and fuse	.030
Waste, 445 loads at $1	.500
Total	$7.956

The rock excavation amounted to 880 cu. yds. and each laborer averaged .088 cu. yd. per hour. In the figures given above for earth excavation and rock excavation by the item "waste" is meant the excavated material that it was necessary to take away; in other words the surplus excavation. The length of the haul was about 2½ miles and where the contractor hired teams for the purpose they were paid by the load at the rate of $1 per load. The figures given for "waste" are what the contractor actually hired teams to remove; but in addition he used some of his own teams for the work of which he kept no close record.

Brick masonry:	Per cu. yd.
Bricklayer, 1,180 hrs. at $1	$1.532
Helpers, 2,400 hrs., at $0.30	.935
Watchman, 480 hrs., at $0.17½	.109
Brick, 340 M., at $9	3.974
Cement, 460 bbls., at $1.80	1.075
Sand, 190 cu. yds., at $1	.247
Total	$7.872

A total of 770 cu. yds. of brick work was constructed; of this amount 73 cu. yds. was constructed of vitrified brick, costing $12.00 per M. Allowing for the extra cost of this vitrified brick brings the total cost of the brick masonry per cubic yard to $7.986. The vitrified brick masonry alone cost $8.116 per cubic yard. Each bricklayer averaged .652 cu. yd. per hour. The plant used in the work and its cost were as follows:

Dynamo, 20 H.P., and electricity for 4 months	$800
Compressor	250
Receiver	25
Air drills (Ingersoll-Rand N. Y.), 3 at $110	330
Pumps, two 2-in. at $60 and one 1-in. at $30	150
Hand windlasses	100
Tools, boots, lights, gasoline, etc.	200

With the exception of the last two items all of the plant was used in rock excavation alone. The earth section of the tunnel was worked from the outlet and there was little pumping required. In the costs given above no charge has been made for plant, nor do the costs include office expenses of the contractor nor insurance of the men. For the information from which this article was prepared we are indebted to Mr. Curtis Hill, C. E., of St. Louis, Mo.

The pollution committee of the Merchants' Association of New York City has notified the Passaic Valley Sewerage Commission that it will fight to the bitter end the construction of the proposed $10,000,000 trunk sewer which is designed to collect the sewage from the Passaic Valley drainage area and discharge it into New York Bay near the Statue of Liberty. This trunk sewer will serve the cities of Newark and Paterson, Passaic, Montclair, the Oranges and all the small towns included in the drainage area of the Passaic Valley, amounting to, according to the estimate furnished by the engineer employed by the commission, 324,000,000 gallons of sewage every 24 hours. The sewage which at the present time is discharged into the waters of New York Bay amounts to nearly 1,000,000,000 gallons each day.

The Kishocoquillas Valley Ry. Co., nine miles long, extending from Belleville to Reedsville, Pa., has asked the Interstate Commerce Commission for authority to issue a trip pass to each stockholder for the entire system. The desire on the part of the management of the road to issue passes is to provide each investor with a souvenir. The fare over the entire road is 18 cts.

Itemized Cost of a 28-Mile Telegraph Line.

The data to be given relate to a telegraph line 28 miles long, built in British Columbia. There were, 32 poles to the mile, strung with a single No. 8 B. B. galvanized iron wire. The cost of the poles was very much less than it would be in most localities, but, since quotations on poles are readily secured, proper substitutions can be made in the following tabulated values for any particular case.

Regarding telegraph wire, a word of explanation may be helpful. Until recently the size of wire commonly used for lines of medium length, up to 400 miles, was No. 9, weighing 305 lbs. per mile, but No. 8 is now used more frequently. There are two grades commonly used: the E. B. B., or "extra best best;" and the B. B., or "best best." A third grade S, or "steel." is also used for short circuits. The following are the weights of galvanized wire:

	Lbs. Per Mile.	Lbs. Per Ft.	Ft. Per Lb.
No. 6	570	0.108	9.2
No. 7	450	0.085	11.7
No. 8	380	0.072	14.0
No. 9	305	0.058	17.4
No. 10	250	0.047	21.2

The itemized cost of this 28 mile line was as follows:

Labor:	
1.0 day, foreman at $3.50	$3.50
1.0 day, sub-foreman at $3.00	3.00
2.7 days, climber at $2.50	6.75
2.5 days, framer at $2.25	5.62
0.7 day, blacksmith at $2.25	1.58
4.6 days, groundman at $2.00	9.20
12.5 days. total at $2.40	$29.65
Materials:	
32 poles (25-ft.) at $1.25	$40.00
32 wooden brackets at 1¼ cts	0.40
32 glass insulators at 0.4 cts	1.28
5 lbs. nails at 2½ cts	0.12
½ lb. staples at 0.3 cts	0.02
380 lbs. No. 8 BB galv. wire at 5 cts	19.00
2 lbs. tie wire at 3 cts	0.06
Total materials	$60.88
Total labor and materials	$90.53

The labor includes the cost of digging holes, erecting poles, stringing the wire, etc. The poles were distributed by train, and the price of $1.25 per pole does not include the train service.

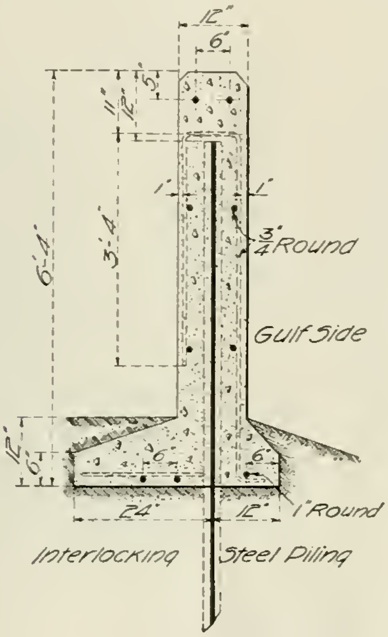
A pole 12 ins. diameter at the butt and 7 ins. at the top, contains ½ cu. ft. of wood per lin. ft. Hence there are about 12½ cu. ft. of timber in a 25-ft. pole. Knowing the kind of timber, it is easy to estimate the weight of poles, and consequently the freight for any given haul. If the timber weighs 40 lbs. per cu. ft. the weight of a pole is about 500 lbs. With 32 poles per mile, the weight is 8 tons for the poles.

In a subsequent issue we shall give the itemized cost of two telephone lines, one 10 miles and one 14 miles long.

For the itemized cost of constructing an electric power transmission line, the reader is referred to our issue of June 26.

Levee and Sea Wall With Steel Sheet Pile Diaphragm at Fort St., Philip Reservation, Louisiana.

The accompanying illustration shows the method of using steel sheet piling to form a water tight diaphragm for a levee at Fort St. Philip Reservation on the Mississippi River, about 74.5 miles below New Orleans. The levee, which is 3,670 ft. long, will be enlarged to a section 8 ft. wide on top with side slopes of 1 on 3; the elevation of the top is 8 ft. above the gulf level and about 6½ ft. above the average ground level. The sheet piling 19 ft. long is to be driven along the gulf edge of the crown level, so as to project about 4 ft. and be embeded some 15 ft. or to a depth of about 7 ft. below the gulf level. Interlocking piles with ⅜-in. webs are specified. To protect the projecting sheeting and to form a sea wall along the top of the levee the upper 5 ft. of the sheeting will be inclosed in a reinforced concrete wall of the dimensions shown in the accompanying drawing. The concrete wall is to be built in 10 ft. sections, with butt joints, and to have four vertical loop bars 1-in. in diameter and four horizontal footing bars in each section. These bars will be arranged one 6 ins. from the joint at each end of the section and the other two so as to give a 3-ft. spacing. The spacing of the longitudinal bars is shown by the drawing. A 1-3-5 broken stone concrete is specified. The quantities per lineal foot of wall and levee will be as follows:



Concrete Sea Wall and Steel Sheet Pile Diaphragm for Levee.

Material:	Per lin. ft.
Concrete, cu. yds	0.279
Reinforcing rods, lbs	25.6
Sheet piling, lbs	665

We are indebted to Col. E. H. Ruffner, Corps of Engineers, U. S. A., for the information from which this brief description has been prepared.

Bids for Dredging Work in Boston Harbor.

The ship channels to Boston harbor are to be improved by the U. S. government at an expense of something over three million dollars, and bids have already been received for a portion of the work. The improvement planned is as follows: The present 35-ft. channel extending from Chelsea Bridge and Charles River Bridge to President Roads will be increased to a maximum width of 1,200 ft., and the present 35-ft. channel from President Roads to the sea at Broad Sound will be increased to a maximum width of 1,500 ft. All depths are the depths below the plane of mean low water. The depth of 35 ft. will be required over the entire areas of the channels to be dredged, except where solid ledges are found above that depth. Where the depth of 36 ft. is obtained it will be paid for. Deductions for dredging to a depth in excess of 36 ft. except as provided below, will be made at the rate of 1.2 cu. yds. From the surface of all solid ledges, found above the depth of 35 ft., all overlying material will be suitably removed so that they can be accurately surveyed and estimated, drilled and blasted. Close around their margins dredging will extend, if required by the engineer, to the depth of 36, and not exceeding 37 ft., which deeper dredging will be paid for at the uniform contract price.

The following bids were received for the work on June 29:

(1) G. H. Breymann & Bros., for all four divisions, 22 cts. per cu. yd. for dredging inside, 40 cts. outside; bowlders greater than 6 tons in weight, $12 inside, $24 outside.

(2) Morris & Cumings Dredging Co., Division 5, Section 5, dredging 25.9 cts.; bowlders $10. Section 5-a, 48.9 cts.; bowlders $10.

(3) Maritime Dredging Co., Division 7, Section 7, dredging 26.75 cts.; bowlders $19.95. Section 7-a, 67.7 cts.; bowlders $23. Division 8, Section 8, 27.75 cts.; bowlders $21. Section 8-a, 67 cts.; bowlders $23.

(4) Daly & Hannan Dredging Co., Division 5, Section 5, dredging 27 cts.; bowlders $8. Section 5-a, 51 cts.; bowlders $15. Division 6, Section 6, dredging 23.9 cts.; bowlders $8. Section 6-a, 44 cts.; bowlders $15. Division 7, Section 7, dredging 28 cents.; bowlders $8. Section 7-a, 52 cts.; bowlders $15. Division 8, Section 8, dredging 28c; bowlders $8. Section 8-a, 52 cts.; bowlders $15.

(5) Eastern Dredging Co., Division 5, Section 5, dredging 28.3 cts.; bowlders $3. Section 5-a, 48.3 cts.; bowlders $8. Division 6, Section 6, dredging 27.3 cts.; bowlders $3. Section 6-a, 48.3 cts; bowlders $8. Division 7, Section 7, dredging 26.3 cts.; bowlders $3. Section 7-a, 53.3 cts.; bowlders $8. Division 8, Section 8, dredging 26 cts.; bowlders $3. Section 8-a, 53.3 cts.; bowlders $8.

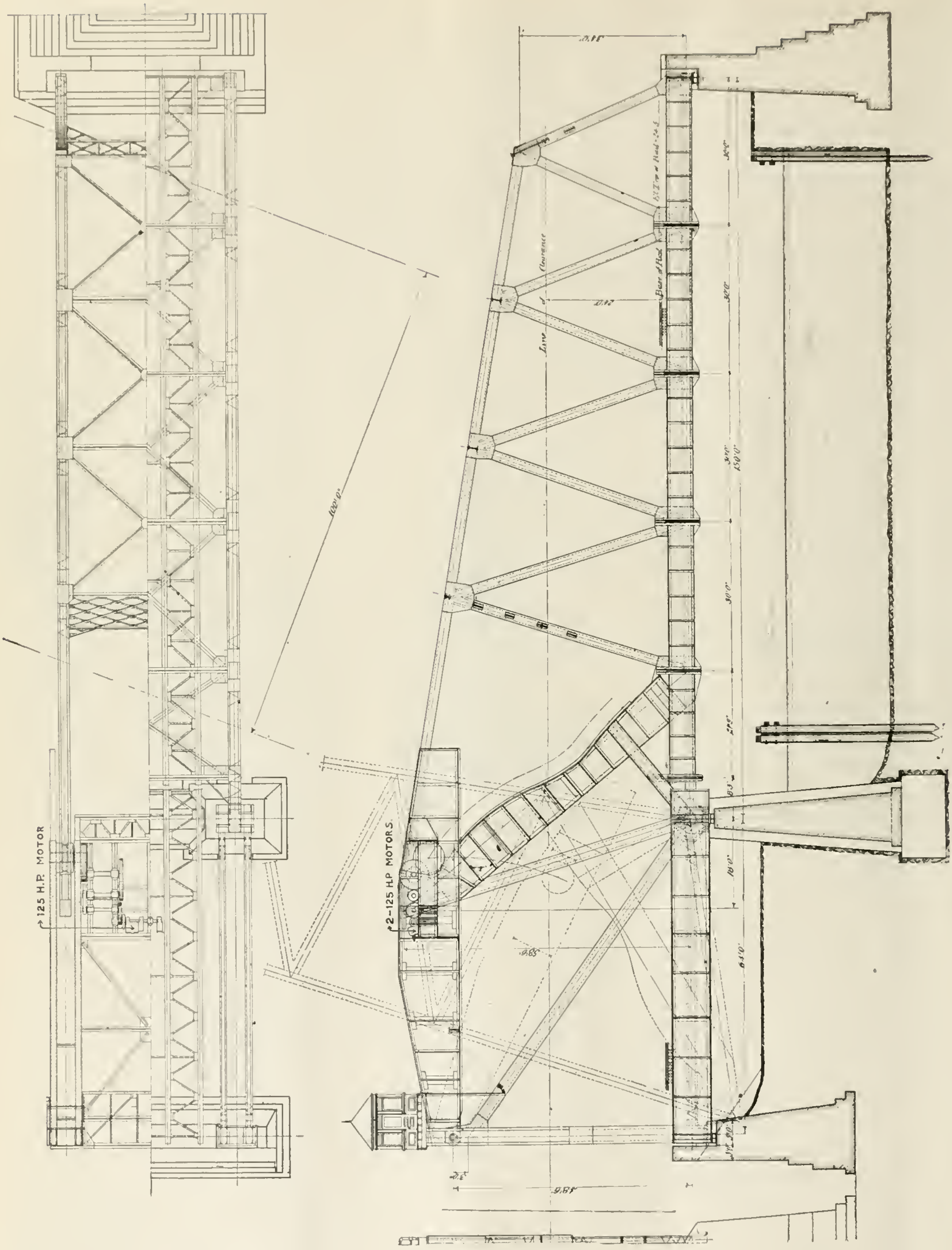


Fig. 1.—Half-plan and Elevation of Page Bascule Bridge.

New Double-Track Railroad Bridge Over the Chicago River.

In connection with the improvement of the south branch of the South Fork, Chicago river, it was decided early in 1904 to replace the old swing bridge with a bridge of the bascule type to give a clear channel of 100 ft. at right angle to the general direction of navigation. After considering several designs of this type it was finally decided to adopt the single leaf, double track bridge of the Page design as being the most economical in cost of construction. The bridge was built jointly and used by the Illinois Central R. R., the A. T. & St. Fe R. R., and the Chicago & Alton Ry. It is also used, under rights granted by the I. C. R. R., by the Wisconsin Central R. R. The design and erection was done under the supervision of the Chicago and Alton R. R. The bridge crosses the river at an angle of 68° 30′ and made necessary a leaf of 150-ft. span to give the required clear channel of 100 ft.

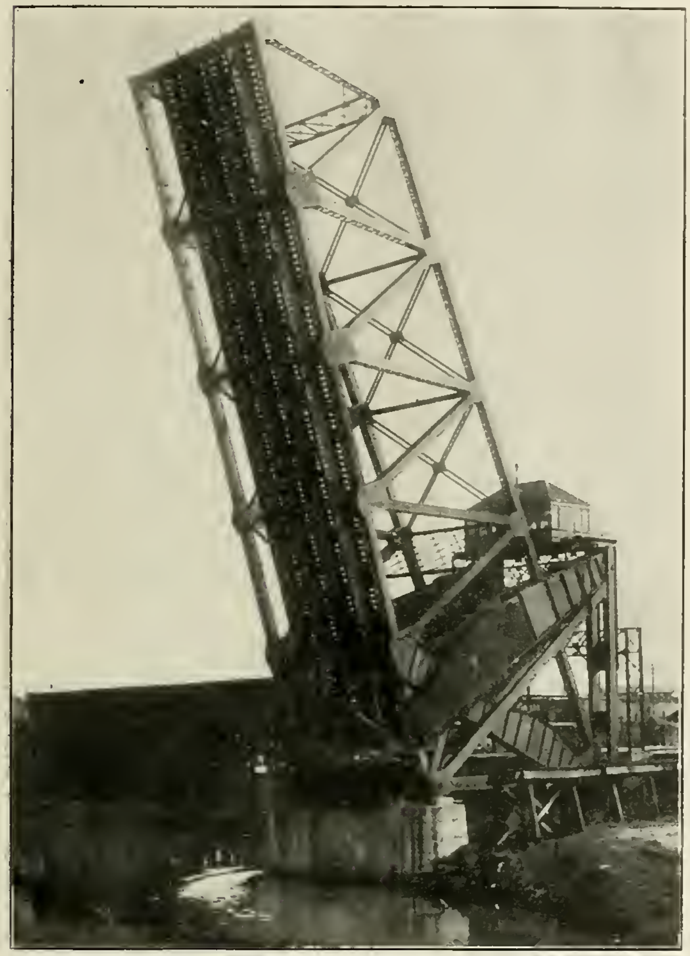


Fig. 2.—Bridge in Upright Position.

Work was commenced on the substructure in March, 1905, and was practically completed by the end of December of the same year. The east abutment and the west river pier were located so as not to interfere in any way with maintenance of traffic over the old bridge, the grade and alignment of the new bridge being the same as the old. The east abutment of the new work was located back of the old center pier, while the west river pier was located back of the old pier which supported end of swing bridge and deck plate girder approach spans. The east abutment rested on a hard pan foundation at minus 22½ ft., Chicago city datum, the wing walk of this abutment being connected up to the retaining walls of the track elevation work at a point about 53 ft. back from face of abutment.

The west river pier also rested on a hard pan foundation at minus 27½ ft. Several difficulties were encountered in making excavation for this pier due to water breaking through under foundation of old pier which consisted of grillage resting on piles at about minus 12 ft. After several attempts to stop this leakage it was finally decided to drive Freistedt steel sheet piling inside of the old pier, and after this no further difficulties were encountered during completion of this work. The maximum load on the foundation of this pier as designed is about 6,000 lbs. per sq. ft. Practically no settlement has taken place up to the present time.

The extreme west abutment rests on a hard clay foundation at minus 13½ ft. This abutment in addition to supporting embankment acts as anchorage due to the uplift of superstructure acting as a cantilever under its dead load when in a nearly horizontal position. The substructure, including walls on east side, comprised a total of about 3,200 cu. yds. The total cost of the new substructure and removal of old substructure, the dredging of the channel to a depth of 21 ft., and timber protection entailed a total expenditure of about $50,000.

The superstructure consists of a single leaf of 150 ft. with an approach span of 64 ft. and is designed to carry on each track a moving load of two engines, weighing 192½ tons each, followed by 5,000 lbs. per lin. ft. The most important feature of the design is that all movable parts are theoretically in balance during operation, the only power required being that to put the bridge in motion and overcome the effect of wind and friction. The girders carrying the counterweights are hinged on a pin near the top of the vertical end posts, and the opposite end of the girders rests on a shaft,

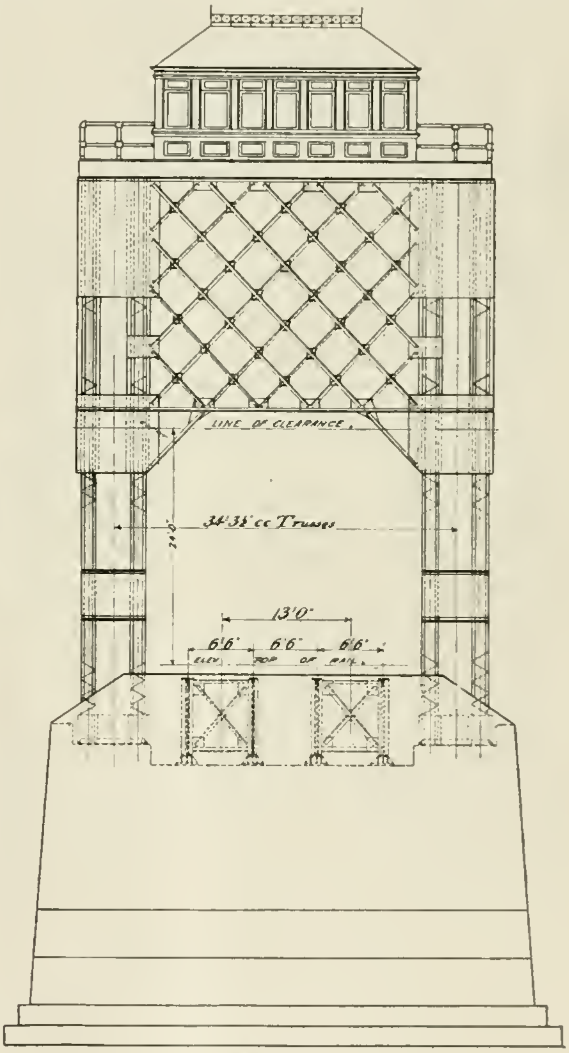


Fig. 3.—End Elevation of Bridge.

which carries the load to rollers running on the track girders. In designing the bridge, the drop of the counter weight girders was such as to give a clear headroom of 17 ft. for the operation of trains during the erection, which necessarily had to be in maximum vertical position. The main driving pinion is keyed to the shaft between the rollers, and engages in a rack running along the center of track girders. To the end of the roller shaft on the inside of the counterweight girder is attached the main driving gear, from which a train of gears lead down to the motor operating the leaf. The gearing and motors are supported on longitudinal girders, these being connected to cross girders, which are attached to the inside counterweight girders; the machinery, motors, and the girders supporting them thus serve as part of the counterweight. The remainder of the counterweight required on the inside girders consists of concrete placed on buckle plates riveted to the machinery girders. The counterweight on the outside girders consists of cast iron blocks bolted to the webs, the blocks being so distributed that the load is practically equal on each of the rollers. The bearings for the trunnions, roller shafts, the rollers and the rear pins on which the counterweight girders are hinged are phosphor bronze; and all shaft bearings are Babbitt metal. The total cost of the superstructure, including the erection and electrical equipment, is about $15,000.

The operation of the bridge is effected by means of two 125-hp. railway type motors, connected to a series-parallel controller in the main bridge tender's house, which is mounted above the tracks over the vertical end posts. An indicator consisting of a number of electric lamps is provided in the tender's house and shows the position of the bridge in four consecutive positions during the operation, by lighting or extinguishing the different lamps. The lighting and extinguishing of the lamps is accomplished through a specially designed contact device connected mechanically to the leaf.

The operating motors are each provided with a magnetic brake. The brakes are automatically applied at the time of stopping the motors at any point and released when motors are in operation. The locking of the bridge in place is effected by means of two wedges moving horizontally at the extreme end in center of lower cords. These wedges in turn slide under rollers mounted in upright standards that are anchored in the abutment, and in operating tend to gradually draw down and lock the bridge into place. The end lock is operated by a 3-hp. inclosed type motor near the end and supported on a platform between the stringers under the tracks. The position of the end lock is shown to the tender by an indicator similar in design to the one which shows the positions of the operating leaf.

The switchboard in the tender's house carries such instruments, circuit breakers, cut-outs and switches as are required on first-class installations of this sort.

While the bridge has been in operation only a comparatively short time, it has been fully demonstrated that the amount of power provided in the motors is more than ample though some difficulties have been experienced in securing a constant voltage requisite to the operation of the motors, current being taken from an electric street car line nearly a mile distant. Tests taken before the machinery and moving parts had time to get smoothed up showed that the bridge requires approximately 70 hp. to raise, or lower, the complete motion, with the motors connected in series, being performed in either direction in about 90 seconds.

Preparatory to the work of making the change from the old to the new structure, arrangements were made to detour all trains for a period of 24 hours, though it was confidently expected that 10 hours would be sufficient. The work of dismantling the old draw span, however, proved so difficult owing to rusted pin connections with worn false shoulders that an interval of 24 hours and 50 minutes was necessary before passage of first train over the new structure. Prior to the change, the bridge could be operated backward and forward through part of its arc which enabled the operation to be thoroughly tested before making the change. An all-electric interlocking plant is now being installed for the safe handling of trains.

The bridge was designed by Mr. W. M. Hughes, bridge engineer of Chicago, under the Page and Schnable patents. The American Bridge Co., of New York, were contractors for the superstructure, the steel work being fabricated at the Lassig plant of that company in Chicago. Messrs. G. P. Nichols & Bro., of Chicago, installed the electrical equipment. The Thos. Phee Co., of Chicago, were contractors for the substructure, and Kelly-Atkinson Construction Co., of Chicago, for the erection of superstructure. The work was carried on under the direction of Mr. W. D. Taylor, Chief Engineer Chicago & Alton R. R. Mr. A. R. Ekstrom, assistant engineer of the Chicago & Alton Ry., had immediate charge of the construction.

Engineers Pocketbook of Reinforced Concrete.*

By E. Lee Heidenreich, C. E., M. E.†

(Continued from Engineering-Contracting, July 3, 1907.)

Before leaving foundations the following description of some of the before-mentioned concrete piles will be given:

Concrete piling offers many advantages which are not obtained with timber piling. In employing concrete, a great saving of material is effected, inasmuch as concrete piles of the same strength and bearing capacity need not be so long as those of wood, and they need not be so numerous. Timber piles, to prevent decay, must be cut off at mean low water, and the footings must be started from this point. With concrete piling, the tops can be left just far enough below the bottoms of the columns to allow for a footing thick enough to carry the superimposed building.

The **Raymond concrete pile**, controlled by the Raymond Concrete Pile Company, Chicago, is placed in the ground by the pile core method, which is as follows: A collapsible steel pile core, encased in a thin, closely fitting sheet steel shell, is driven by a pile driver to the required depth. In the accompanying cut are shown two views of this core, the view to the left showing the shell driver and the core expanded. The view to the right shows the pile core collapsed and ready to be drawn from the shell. This shell, which is left in the ground, acts as a mould for the concrete, protecting it from back pressure, which would distort the pile, and from the admixture of foreign matter which would impair the bond of the concrete. An electric light can be lowered at intervals during the placing of the concrete, to enable the operator to see just what condition prevails. When reinforcement is desired, the reinforcing material is inserted in the shell before the placing of the concrete. The piles are tapered to obtain greater bearing value, since the load on a tapered pile is more uniformly distributed along the entire length.

The **Simplex pile**, controlled by the Simplex Concrete Piling Company, Philadelphia, is constructed as follows: A wrought iron driving pipe of the diameter and length of the intended pile, and of sufficient strength to withstand driving, with a point made of cast iron or steel and capped with a hardwood driving head which protects the pipe from being injured during driving, is driven to a firm bearing, the pipe is withdrawn and the hole filled with concrete.

The foundation for the New River and Railroad Terminal Warehouse Building at Pittsburg, Pa., is constructed on 48,000 16-in. Simplex piles from 30 to 45 ft. long, driven through filled-in ground. The actual time of driving was 76 working days. The illustration shows a Simplex pile, which is cylindrical instead of tapered, and the following advantages are claimed for same: A greatly increased superficial friction or bearing surface is augmented by the roughness of its sides, resulting from the larger pieces of aggregates which are forced into its sides by being rammed after the encasing pipe has been partly withdrawn. Another advantage which the company claims is that the firmness of the soil increases as the pile reaches its lower levels and that consequently the carrying capacity increases where the overlying strata are of a soft or marshy nature, 1 sq. ft. of side surface friction at the bottom of a 30 ft. pile being quite equal to 2 sq. ft. halfway up, and possibly in some cases equal to 10 sq. ft. at the top.

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†13-21 Park Row, New York, N. Y.

The **Hennebique pile**, which has been used abroad since 1896, is square with a pointed iron shoe and reinforced by iron rods longitudinally connected by means of horizontal stirrups.

The **Corrugated** Concrete Pile Company of New York manufactures piles which are octagonal in section and are corrugated longitudinally like a fluted column. There is a hole extending the length of the pile, so that same can be driven by water jet, the water being forced down through the hole and returning along the corrugated sides.

A number of other piles are employed, such as Williams pile, and others. These are all manufactured piles and most of them arranged to be jetted down. All the above piles are manufactured with reinforcing rods, although the Raymond and the Simplex types very often are used without reinforcing rods.

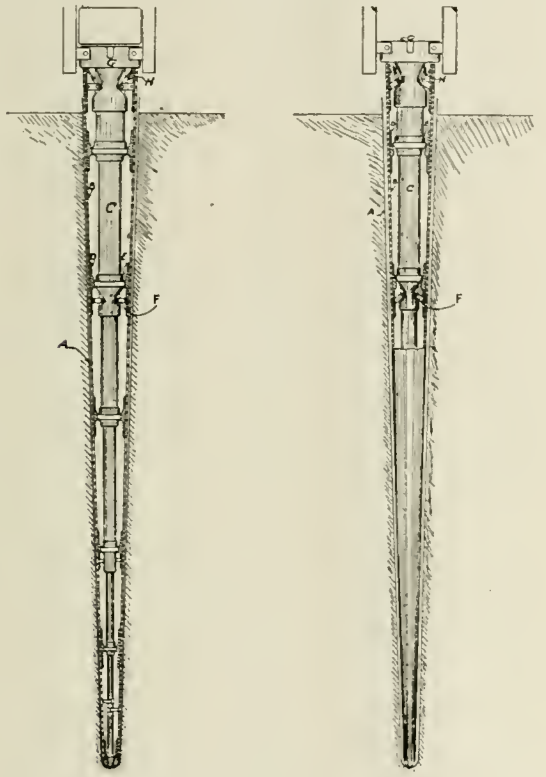

Fig. 1.—Collapsible Steel Pile Core for Raymond Concrete Pile.

Raft Foundations.—To show the value of a raft foundation for treacherous soil, a brief description is here given of the foundation for the Co-operative Wholesale Society, Ltd., at Newcastle-on-Tyne, England. The building rises above the quay-level on which it abuts, and consists of basement, ground-floor and 6 upper floors. The frontage is 92 ft., and the depth 125 ft. The subsoil was of the poorest quality for foundations, consisting of 18 ft. of made ground, principally clay, 18 ft. of silt and quicksand, 10 ft. of soft clay, 5 ft. of hard clay, 10 ft. of silty sand and finally gravel. The above stratification had a decided dip toward the river Tyne. To carry the enormous weight of the superimposed building, several plans for foundation were proposed. It was at first intended to construct the building of brick on a foundation of cylinders 6 ft. 6 ins. in diameter, sunk from 20 to 62 ft. below the ground level, carrying a sill of concrete 4 ft. thick reinforced with rails. Another alternative considered was the driving of piles to the same depth, but the liability of injuring the adjoining property proved this method inadvisable. Finally, both these projects were abandoned and it was decided to construct a raft of reinforced concrete over the whole area of the ground. This raft, as constructed, measures 2 ft. 6 ins. in its thickest part and only 7 ins. in the thinnest part, as shown in the illustration. The entire site is divided up into rectangles measuring generally 14 ft. 8 ins. by 14 ft. 6 ins. Each side of these rectangles is a reinforced concrete beam 6 ft. 6 ins. deep by 2 ft. 5 ins. wide at the bottom, the reinforcement being according to the Hennebique system.

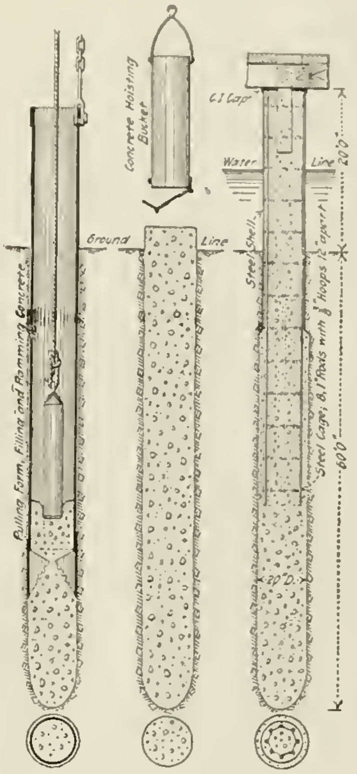
Concrete Hoisting Bucket
C.I. Cap
Water
Line
20'0"
Ground
Line
Steel Shell
Pulling Form, Filling and Ramming Concrete
Steel Cage; 8, 1" Rods with 3/8" Hoops 12" apart
60'0"
20" D.

Fig. 2.—Sketches Showing Construction of Simplex Piles.

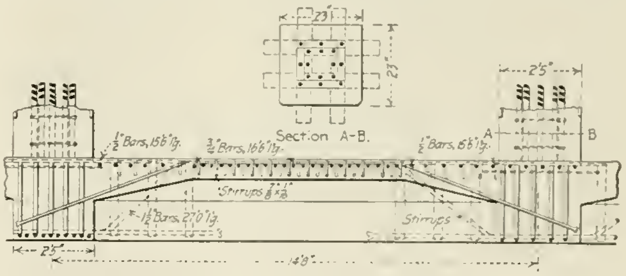

Fig. 3.—Raft Foundation for 6-Story Warehouse, New Castle-on-Tyne, England.

The steel reinforcement along the bottom at the mid-spans consists of ten 1½-in. round rods. At the end of each beam half of the bars are carried up to the upper surface, this arrangement being a characteristic feature of the Hennebique system. Light steel stirrups also extend from around the bottom bars up to the upper surface, in the ordinary manner, thus tying the concrete together in a vertical direction. The concrete floor filling in each rectangle is constructed on practically the same system; but the bars used are of much lighter section, being in some cases ½-in. and in others ¾-in. in diameter. The columns which support the upper floors are also of reinforced concrete. They are placed at the corners of the foundation "squares." The reinforcement here is of 2-in. bars, which are carried right into the foundation. At higher levels, where the total load to be carried is naturally less, the reinforcement is, of course, much lighter, the weight of steel used and the size of the columns being accurately proportioned to the load to be carried. At the foundation level the columns measure 29 ins. square, and diminish to 8 ins. at the sixth floor. Thus, if settlement takes place, the entire building settles as a solid block, and therefore cannot suffer any deterioration from unequal settlement. In the particular case of this warehouse, there has been a settlement of 3½ ins. at the front and of 3 ins. at the rear, which took place between the date of construction of the foundations and of the first floor. Since then no further settlement has taken place nor is any anticipated.

Catalogs Worth Having.

No. 0270. **Flexible Metallic Hose and Tubing.** The New York Flexible Metallic Hose & Tubing Co., New York, N. Y.

The "hose" described in this circular is built up of twisted ribbon-like strips of pliable steel or copper having their edges formed into interlocking lips, the joints of which are packed with asbestos or rubber. For special purposes this "hose" is enclosed in a lead casing and for water pipe it is given a sheet lead lining as well as a casing.

No. 0271. **Crushing and Grinding Machinery.** The Sturtevant Mill Co., Boston, Mass.

This catalog describes briefly and gives the main dimensions and capacities of the large line of crushing and grinding machinery manufactured by the well-known firm named above. The machinery includes all grades of apparatus from stone crushers for coarse work to machines capable of doing the very finest grinding. It also contains illustrations of screens, elevators and other appurtenances to crushing and grinding machinery plants.

No. 0272. **Headgate Hoists.** The Dayton Globe Iron Works Co., Dayton, O.

This pamphlet gives a brief description of the line of hoisting mechanisms for headgates, waste gates, etc., which is handled by the firm named. Each of the various mechanisms is illustrated and described briefly. The line includes machines of various capacity.

No. 0273. **Concrete Blocks.** The Runyan Concrete Machinery Co., Cleveland, O.

This circular describes the "Runyan, Junior," concrete block machine, for which several advantages are claimed. The machine is very simple in construction and is said to be the only block machine having an arched longitudinal, horizontal core. It is also said to be the only machine that will make a down face and side face block.

No. 0274. **Lamps, Circuit Breakers and Fan Motors.** General Electric Co., Schenectady, N. Y.

Two of the pamphlets referred to in this notice describe the automatic circuit breakers and the fan motors manufactured by the above named firm. The third pamphlet describes the Edison Gem Filament Lamp, for which a large number of claims are made of superior capacity and durability. The lamp is described in some detail and figures and diagrams are given showing results of tests made with it. The pamphlet is an interesting one.

No. 0275. **Feed-Water Heaters.** The American Incline Filter & Heater Co., Marion, Ohio.

This is an exceedingly well written and illustrated descriptive pamphlet of the special type of feed-water heater manufactured by the firm named. The pamphlet opens with a general discussion concerning the economy of feed-water heating and then proceeds to describe in detail the construction and operation of the special heater which it advocates. Anyone who is interested in this subject should secure the pamphlet and add it to his files.

No. 0276. **Bitumen-Emulsion.** Theodore F. Koch, Chicago, Ill.

The bitumen-emulsion described in this catalog is advocated for waterproofing all forms of structures. It is particularly recommended as a waterproofing for concrete. The catalog describes the character of the emulsion, the method of applying it under various conditions, and gives results showing the success of its operation.

No. 0277. **Gears.** The C. O. Bartlett & Snow Co., Cleveland, O.

This is a catalog and price list of the large line of gears manufactured by the firm named. The information is given in tabular form for convenient reference in deciding upon the arrangement of gearing and to facilitate ordering material. The company has, in addition, a general catalog of a more descriptive character.

No. 0278. **Concrete Blocks.** The American Hydraulic Stone Co., Denver, Colo.

In this circular the company named reprints an article describing the effect of fire on a concrete block building for Montgomery & Co., at Nashville, Tenn. The building was constructed of the two-piece block made by the American Hydraulic Stone Co., and although subjected to a severe fire, suffered but very little damage, so far as the concrete work was concerned. The circular is an interesting one and does much to give confidence in the fireproof qualities of concrete block construction.

Personal.

Mr. Le Roy Leach, of Tilford, South Dakota, has been appointed Assistant State Engineer of South Dakota.

The Sargent Engineering Co. has changed its offices from the First National Bank bldg., Chicago, Ill., to 1005 Plymouth bldg., that city.

Messrs. George G. Scudder, 239 West 45th St., New York, and Guy Vroman, 2340 Seventh Ave., New York, have been appointed Assistant Engineers to the Board of Water Supply of New York City.

Major Harry F. Hodges, Corps of Engineers, U. S. Army, has been appointed by the Secretary of War to the position of Purchasing Officer of the Isthmian Canal Commission and will have his headquarters in Washington. He succeeds Mr. D. W. Ross, whose resignation takes effect July 15.

Mr. John R. Burke, for ten years Assistant Engineer of the Massachusetts Board of Harbor and Land Commissioners at Boston, has resigned to engage in contracting for dredging and river and harbor improvements. His temporary headquarters will be at 56 Lincoln Ave., Wollaston, Mass.

Mr. H. R. Safford has been appointed Chief Engineer of Maintenance of Way of the Illinois Central, the Indianapolis Southern, and the Yazoo and Mississippi Valley roads. The office of assistant chief engineer on all these roads has been abolished. Mr. Safford's headquarters will be in Chicago.

General William W. Duffield, for many years Superintendent of the United States Coast and Geodetic Survey, and said to be the oldest graduate of Columbia College, New York, died June 23. He was a native of Carlisle, Pa., but spent much of his life in Michigan. He was brigadier general in the Civil War.

Mr. O. H. Gentner, Jr., of Philadelphia, well known throughout the East through his connection with important building operations, has been engaged as Assistant Engineer in charge of estimating and drafting in the Reinforced Concrete Department by the General Fireproofing Co., and will make his headquarters at Youngstown, O.

The engagement has been announced of Miss Blanche O. Conover, a well known teacher of Port Jefferson, N. Y., to Mr. Chas. J. Steffens, Secretary and Manager of the Guarantee Construction Co. of New York. Mr. Steffens is a member of the Brooklyn Engineers' Club, American Institute of Mining Engineers, and various Masonic orders. The wedding is to take place in the late fall.

CONTRACT NEWS

We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Bids Open.		See Issue
July 10.	Toledo, O.	June 19
July 10.	Nashville, Tenn.	June 12
July 11.	Washington, D. C.	June 26
July 11.	Hardin, Ill.	July 10
July 12.	Danville, Ind.	July 10
July 12.	Indianapolis, Ind.	June 26
July 12.	Cincinnati, O.	June 19
July 12.	Wapakoneta, O.	July 3
July 13.	Cleveland, O.	June 19
July 13.	Findlay, O.	July 10
July 13.	Sidney, O.	July 10
July 13.	Bluffton, Ind.	July 10
July 15.	Rushville, Ind.	July 10
July 15.	Ukiah, Cal.	July 10
July 15.	Portland, Ind.	July 10
July 15.	Chicago, Ill.	July 10
July 15.	New Orleans, La.	June 12
July 15.	Athens, Ga.	July 3
July 15.	San Jose, Cal.	July 3
July 15.	Mt. Pulaski, Ill.	July 3
July 15.	Dillon, Mont.	July 3
July 15.	Barnstable, Mass.	July 3
July 15.	Jefferson, O.	July 3
July 16.	Newcastle, Ind.	July 3
July 16.	Toronto, Ont.	June 19
July 16.	Sandusky, O.	June 26
July 16.	Mount Gilead, O.	July 10
July 17.	Sandusky, O.	July 3
July 19.	Fort Snelling, Minn.	June 19
July 19.	Ottawa, Ill.	July 10
July 19.	Cincinnati, O.	July 10
July 20.	Culpeper, Va.	June 26
July 20.	San Juan, Porto Rico	June 12
July 23.	Columbia City, Ind.	July 3
July 27.	Cleveland, O.	July 3
July 27.	Elberton, Ga.	July 10
July 29.	Chardon, O.	July 3
July 31.	Hattiesburg, Miss.	July 10
Aug. 3.	Cleveland, O.	July 10
Aug. 5.	Jackson, O.	July 10

Buildings.

July 10.	Springfield, O.	June 19
July 10.	Knoxville, Tenn.	June 19
July 10.	New York, N. Y.	July 3
July 10.	Wichita, Kan.	July 3
July 10.	Washington, D. C.	July 3
July 11.	Philadelphia, Pa.	July 3
July 11.	Vineland, N. J.	July 3
July 11.	Chicago, Ill.	June 26
July 12.	Sandusky, O.	June 26
July 12.	Greensburg, Ind.	July 3
July 12.	Syracuse, Ind.	July 3
July 12.	Syracuse, Ind.	July 10
July 12.	Bringhurst, Ind.	July 10
July 15.	Petersburg, Ind.	July 3
July 15.	Tuscumbia, Ala.	July 3
July 15.	Paris, Tex.	July 3
July 15.	Fort Slocum, N. Y.	July 3
July 15.	Wilkes-Barre, Pa.	June 26
July 15.	Paris, Tex.	June 26
July 15.	Cleveland, O.	June 26
July 15.	Nelson, B. C.	June 26
July 15.	Sheboygan, Wis.	June 19
July 15.	New York, N. Y.	July 10
July 15.	New York, N. Y.	July 10
July 15.	Brooklyn, N. Y.	July 10
July 15.	San Dimas, Cal.	July 10
July 16.	Boston, Mass.	July 10
July 16.	Newark, N. J.	July 10
July 16.	Devay, Ind.	July 10
July 16.	Newark, N. J.	June 19
July 16.	Washington, D. C.	July 3
July 17.	Fort Benjamin Harrison, Ind.	July 10
July 17.	St. Joseph, Mo.	June 26
July 18.	Washington, D. C.	June 26
July 18.	Chattanooga, Tenn.	June 26
July 18.	Williamsport, Ind.	June 12
July 18.	Baxley, Ga.	July 3
July 18.	Wilkesbarre, Pa.	July 3
July 18.	Wapakoneta, O.	July 3
July 18.	Neah Bay, Wash.	July 3
July 19.	Buffalo, N. Y.	July 10
July 19.	Gainesville, Fla.	June 19
July 19.	Gainesville, Fla.	June 26
July 19.	Athens, O.	June 26
July 19.	Fort Leavenworth, Kan.	July 3
July 20.	Minneapolis, Minn.	July 3
July 20.	Fresno, Cal.	July 3
July 20.	Jacksonville, Fla.	July 3
July 20.	Pickens, S. C.	July 10
July 20.	Franklin, Ind.	July 10
July 20.	Newberry, Ind.	July 10
July 22.	Franklin, Ind.	July 10
July 22.	East Orange, N. J.	July 3
July 22.	Casper, Wyo.	June 26
July 23.	Cheyenne, Wyo.	July 3
July 23.	Bishopville, Ga.	July 10
July 23.	Cortlandt, N. Y.	July 10
July 24.	Hoboken, N. J.	July 10
July 24.	Fort Sam Houston, Tex.	July 3
July 24.	Aurora, Ill.	June 26
July 25.	Marion, Ind.	July 10
July 27.	Potosi, Mo.	July 10
July 29.	Yuma, Ariz.	July 10
July 31.	Owosso, Mich.	July 3
Aug. 1.	Washington, D. C.	July 10
Aug. 5.	Crookston, Minn.	July 3
Aug. 6.	Columbus, O.	July 10
Aug. 9.	Monticello, Ind.	July 3
Aug. 12.	Mason City, Ia.	July 3

Roads and Streets.

July 10.	St. Bernard, O.	July 3
July 10.	Indianapolis, Ind.	July 3
July 10.	Albany, N. Y.	July 3
July 10.	Brooklyn, N. Y.	July 3
July 10.	Cincinnati, O.	July 3
July 10.	Baltimore, Md.	July 3
July 10.	St. Clairsville, O.	June 26
July 10.	Atlantic City, N. J.	June 26
July 11.	Sullivan, Ind.	June 26
July 11.	Chicago, Ill.	July 3
July 12.	Indianapolis, Ind.	July 3
July 12.	St. Louis, Mo.	July 3
July 12.	Hudson, Mich.	July 3
July 12.	Cincinnati, O.	June 26
July 12.	Memphis, Tenn.	July 10
July 12.	Richmond, Ind.	July 10
July 13.	Cleveland, O.	June 19
July 13.	Balls Bluff, Va.	June 19
July 15.	Cincinnati, O.	July 3
July 15.	Sedalia, Mo.	July 3
July 15.	Green Bay, Wis.	July 3
July 15.	St. Paul, Minn.	July 10
July 15.	Jersey City, N. J.	July 10
July 15.	Ingram, Pa.	July 10
July 15.	East Pittsburg, Pa.	July 10
July 15.	Muskegon, Mich.	July 10
July 15.	New Orleans, La.	July 10
July 15.	Ogden, Utah	July 10
July 15.	Bensalem, Pa.	July 10
July 15.	St. Paul, Minn.	July 10
July 15.	Greensburg, Ind.	July 10
July 15.	Shepherdsville, Ky.	July 10
July 16.	Milwaukee, Wis.	July 10
July 16.	Buffalo, N. Y.	July 10
July 16.	New York, N. Y.	July 10
July 16.	Irvington, N. J.	July 10
July 16.	Newcastle, Ind.	July 3
July 16.	Chardon, O.	July 3
July 16.	Cleveland Heights, O.	June 19
July 17.	Brooklyn, N. Y.	July 10
July 17.	Sewickley, Pa.	July 10
July 18.	Brookhaven, N. Y.	July 10
July 18.	St. Paul, Minn.	July 10
July 18.	Wilkesbarre, Pa.	July 10
July 18.	Wellsville, O.	July 10
July 18.	Spencer, Ind.	July 10
July 19.	Youngstown, O.	July 10
July 19.	Cincinnati, O.	July 3
July 19.	Columbus Barracks, O.	July 3
July 19.	Bluffton, Ind.	July 3
July 19.	Fort Leavenworth, Kan.	July 3
July 20.	Oshkosh, Wis.	July 3
July 20.	Findlay, O.	July 3
July 20.	Greencastle, Ind.	June 26
July 20.	Crawfordsville, Ind.	June 26
July 20.	Findlay, O.	June 26
July 23.	Painesville, O.	July 3
July 23.	Mount Gilead, O.	July 10
July 26.	Cincinnati, O.	July 10
July 27.	Cleveland, O.	July 3
July 30.	Jefferson, O.	July 10
July 30.	DesMoines, Ia.	July 10
July 30.	Hagerstown, Md.	July 10
July 31.	Kansas City, Mo.	July 10
Aug. 1.	Greencastle, Ind.	July 3
Aug. 2.	Cincinnati, O.	July 10
Aug. 5.	Boonville, Ind.	July 10
Aug. 6.	Sharpsville, Pa.	July 10

Sewers.

July 10.	Buffalo, N. Y.	July 3
July 11.	Chicago, Ill.	July 3
July 13.	Norwood, O.	July 3
July 13.	Milwaukee, Wis.	July 10
July 15.	Albany, N. Y.	July 10
July 15.	Washington, D. C.	July 10
July 15.	Cresson, Pa.	July 10
July 15.	Steubenville, O.	July 3
July 15.	Brookings, S. Dak.	June 26
July 16.	Torrington, Conn.	July 3
July 16.	Cleveland Heights, O.	June 19
July 16.	Milwaukee, Wis.	July 10
July 16.	New York, N. Y.	July 10
July 17.	Iron River, Mich.	July 10
July 18.	Wellsville, O.	July 10
July 19.	Youngstown, O.	July 10
July 19.	Spencer, La.	July 10
July 20.	Oshkosh, Wis.	July 10
July 20.	Pensacola, Fla.	June 26
July 22.	Willoughby, O.	June 19
July 22.	San Jose, Cal	July 3
July 22.	Philadelphia, Pa.	July 10
July 22.	Cordele, Ga.	July 10
July 24.	Oakland, Cal.	July 10
July 24.	Aberdeen, Wash.	July 10
July 24.	Henderson, N. C.	July 10
July 25.	Janesville, Wis.	July 10
July 25.	Frankfort, Ind.	June 19
July 25.	Frankfort, Ind.	June 26
July 30.	DesMoines, Ia.	July 10
Aug. 6.	Alexandria, La.	July 3
Sept. 11.	New Orleans, La.	July 10

Water Supply.

July 10.	Columbus, O.	June 26
July 10.	Joliet, Ill.	July 3
July 11.	New York, N. Y.	July 3
July 11.	Chicago, Ill.	July 3
July 12.	Bloomer, Wis.	July 3
July 12.	Indianapolis, Ind.	June 26
July 13.	Milwaukee, Wis.	July 10
July 15.	North Milwaukee, Wis.	June 26
July 15.	Elizabeth, N. J.	July 10
July 16.	New York, N. Y.	July 10
July 16.	Comfrey, Minn.	July 10
July 16.	Sayre, Okla.	June 26
July 20.	St. Paul, Minn.	July 3
July 22.	Omaha, Neb.	July 3
July 22.	Burlington, Vt.	July 10
July 26.	Decatur, Ill.	July 10
July 31.	North Battleford, Sask.	July 3
Aug. 19.	Sacramento, Cal.	June 5
Sept. 4.	New Orleans, La.	July 3

Miscellaneous.

July 10.	Oakland, Cal., Street Sweeping,	July 3
July 10.	New York, N. Y., Breakwater Extension,	June 12
July 10.	Chicago, Ill., Foundation Work,	June 26

July 10. Crystal Falls, Mich., Power Station Addition, June 26
——— Charlestown, Mass., Concrete Coal Pocket, July 10
July 11. Houghton, Mich., Power House, Tunnel, July 10
July 11. New York, N. Y., Planting Trees, Etc., July 3
July 12. Fort Morgan, Ala., Sea Wall, June 19
July 15. Petit Roches, N. B., Breakwater Extension, July 3
July 15. Fort St. Philip, La., Sheet Pile Sea Wall, June 19
July 15. Brookline, Mass., Street Lighting, July 10
July 15. Grove City, O., Street Lighting, July 10
July 15. New Orleans, La., Concrete Work, July 10
July 16. West Point, N. Y., Steam Piping, July 3
July 16. Newport, R. I., Garbage Plant, July 3
July 17. Fort Myer, Va., Garbage Crematory, June 26
July 18. Brooklyn, N. Y., Riprap Sea Wall, July 3
July 18. Albany, N. Y., Aqueduct, June 26
July 18. Cincinnati, O., Concrete Dam, June 26
July 18. Buffalo, N. Y., Foundation Work, July 10
July 18. Boston, Mass., Subway Entrance, July 10
July 18. Washington, D. C., Concrete Conduit, July 10
July 22. Fort D. A. Russell, Wyo., Garbage Crematory, July 3
July 23. Fort Morgan, Ala., Wharf Repairs, Etc., July 3
July 26. Holland, Mich., Pier Repairs, July 3
June 26. Winnetka, Ill., Pile Pier, June 26
July 27. Boston, Mass., Concrete Floor, July 3
July 29. Milford Haven, Va., Riprap Jetties, July 10
July 30. Fort Monroe, Va., Track Work, July 10
July 30. New York, N. Y., Retaining Wall, July 3
Aug. 1. Washington, D. C., Torpedo Boats, June 5
Aug. 2. Racine, Wis., Breakwaters, July 10
Aug. 3. San Juan, R. I., Pier Repairs, June 26
Aug. 5. Harrisburg, Pa., Garbage Disposal, June 26
Aug. 6. Cleveland Heights, O., Street Lighting, July 10
Aug. 6. New York, N. Y., Dams, July 10
Aug. 20. San Diego, Cal., Wharf and Trestle, June 26
Sept. 3. Winnipeg, Man., Hydro-Electric Development, June 19

Excavation, Earth and Rock.

July 10. New Orleans, La., Levee Work, June 26
July 10. Estherville, Ia., Levee Work, June 26
July 10. New York, N. Y., Dredging, June 12
July 10. Jerseyville, Ill., Excavation, Filling, Etc., June 19
July 10. Pensacola, Fla., Railroad Grading, July 3
July 10. Des Moines, Ia., River Improvement, July 3
July 10. Baltimore, Md., Test Well, July 3
July 12. Albany, N. Y., Excavation, June 26
July 12. Boston, Mass., Dredging, July 10
July 13. Collinston, La., Excavation, June 19
July 15. New York, N. Y., Rock Excavation, July 10
July 15. Henrietta, Tex., Railroad Grading, Etc., July 10
July 15. Portland, Ind., Levee, July 10
July 16. Boone, Ia., Tile Drains, July 10
July 17. Baltimore, Md., Dredging, July 10
July 15. Urbana, O., Excavation, June 19
July 17. New York, N. Y., Dredging, June 19
July 17. Newport, R. I., Dredging, June 19
July 17. Block Island, R. I., Dredging, June 26
July 18. Grand Rapids, Mich., Rock Excavation, Etc., July 3
July 20. Charleston, S. C., Dredging, June 26
July 20. Portsmouth, N. H., Ledge Removal, June 26
July 20. Charleston, S. C., Dredging, July 3
July 24. Jacksonville, Fla., Dredging, June 26
Aug. 24. New York, N. Y., Dredging, July 3
July 24. New York, N. Y., Dredging, July 3
July 21. Carroll, Ia., Ditch Work, July 3
July 27. Woodbridge, N. J., Dredging, July 3
June 29. York, Ill., Ditch Work, June 26
July 29. Skagway, Alaska, Dredging, Etc., June 19
July 30. Newark, N. J., Dredging, July 3
July 31. Albany, N. Y., Barge Canal Work, July 10
July 31. Galveston, Tex., Dredging, July 10
Aug. 1. Marshalltown, Ia., Drainage Ditch, July 10
Aug. 1. Emmetsburg, Ia., Drainage Work, July 3
Aug. 1. Nevada, Ia., Ditch Work, July 3
Aug. 7. San Juan, P. R., Dredging, July 3

Materials, Machines, Supplies, Tools Etc

July 10. Columbus, O., Pumping Machinery, June 26
July 10. Chicago, Ill., Boiler Feed Pumps, July 3
July 11. Charleston, S. C., Lumber, Rubble Stone, July 3
July 12. St. Paul, Minn., Electric Elevator, July 3
July 12. Kansas City, Mo., Fire Hydrants, July 3
July 13. Georgetown, O., Electric Equipment, June 19
July 15. Albany, N. Y., Special Castings, July 10
July 15. New Orleans, La., Track Bolts, Spikes, Etc., July 10
July 15. Checotah, Ind. T., Waterworks Equipment, July 10
July 16. New York, N. Y., Road Rollers, July 10
July 16. New York, N. Y., Cable, Fire Alarm Supplies, July 10
July 16. New York, N. Y., Broken Stone, July 10
July 16. Eufaula, Ind. T., Pumps, Pipe, Etc., July 10
July 16. Washington, D. C., Portable Track, Cement, Etc., July 3
July 16. Washington, D. C., Drafting Materials, July 3
July 16. Washington, D. C., Steam Shovels, Plows, Etc., July 3
July 17. Fort Benjamin Harrison, Ind., Troughs, Etc., July 10
July 18. Commerce, Tex., Waterworks Equipment, July 10
July 18. Cleveland, O., Garbage Cars, July 10
July 18. Wilkesbarre, Pa., Vitrified Paving Blocks, July 10
July 20. Washington, D. C., Wire, July 10
July 20. Puget Sound, Wash., Traveling Cranes, June 26
July 22. Washington, D. C., Chain, Wire Rope, Etc., July 10
July 23. Hoboken, N. J., Fire Engines, July 3
July 23. Mare Island, Cal., Cement, Pipe, Etc., July
July 30. San Francisco, Cal., Boilers, July 3
July 25. Omaha, Neb., Electric Elevator, July 3
July 30. Fort Monroe, Va., Locomotive, Cars, July 10
July 30. Columbus, O., Engine, Dynamo, Etc., July 10

BIDS ASKED.

Bridges.

Items Arranged Alphabetically by States.

Ukiah, Cal.—Bids are asked by County Supervisors, until noon, July 15, for constructing bridge over Novarro River.

Elberton, Ga.—Bids are asked by Commissioners of Roads and Revenues for Elbert and Wilkes Counties, until July 27 for erection of steel bridge across Broad river at Bells Ferry. Plans, etc., on file in office of Commissioner of Elbert County at Elberton, Ga., or of Wilkes County at Washington, Ga. Bridge to consist of two steel spans resting on old rock piers now standing in river; counties to furnish material and build approaches. Bridge is to cost not more than $5,000.

Chicago, Ill.—Bids are asked by John J. Hanberg, Commissioner Public Works, until 11 a. m. July 15, for labor and material to complete the east approach to the North Avenue bridge over the north branch of the Chicago River, according to plans and specifications on file in the office of the Department of Public Works, Room 326 City Hall. Certified check for $100 required with bid.

Bluffton, Ind.—Bids are asked by Commissioners of Wells County, until July 13, for constructing a number of bridges of from 14 ft. to 40 ft. span.

Danville, Ind.—Bids are asked by Commissioners of Hendricks County, at Danville until 10 a. m., July 12, for the construction of three new bridges and the repair of one bridge. Plans are on file with David Mills, County Auditor.

Portland, Ind.—Bids are asked by Commissioners of Jay County, until 10 a. m., July 15, for the following work: Construction of one set stone abutments, located Sec. 21, Pike Township; construction of one set stone abutments and stone top bridge, located between Secs. 9 and 10, Penn Township; construction of a stone culvert in Sec. 23, Wayne Township. W. Lea Smith, County Auditor.

Rushville, Ind.—Bids are asked by Commissioners of Rush County, at Rushville, until 2 p. m., July 15, for the construction of Hinchman bridge; also 30 ft. concrete abutments and top and concrete floor for Percy Walker bridge. Albert Winship is County Auditor.

Hardin, Ill.—Bids are asked by County

Commissioners, John Day, County Clerk, until July 11, for the construction of a bridge across Bay Creek, four miles northwest of Belleview.

Ottawa, Ill.—Bids are asked by W. A. Dunaway, County Surveyor, until 1 p. m., July 19, for the construction of a steel highway bridge over Four Mile Grove Creek, on Section 22, Meriden Township. The work consists of building two concrete abuttments 20 ft. long and about 14 ft. high with wing walls, two of which are about 16 and 10 ft. long and two to be 6 ft. each, and the erection of one 60 ft. span 16 ft. roadway.

Hattiesburg, Miss.—Bids are asked by City Clerk, until 8 p. m., July 31, for the construction and erection of the superstructure of four steel highway bridges over Gordons Creek, this city, according to plans and specifications on file with J. H. Putnam, City Engineer. The spans of these bridges range approximately from 65 to 75 ft. They are to be of the plate girder type, 30 ft. wide center to center. Bids must be made separately for each of the four bridges.

Findlay, O.—Bids are asked by County Auditor Sutton until 10 a. m., July 13, for the following improvements: Repair of bridge abutments on bridge near the Wagner farm in Eagle Township. Repair of bridge over Fundum ditch, on the Ridge road in Pleasant Township. This improvement will consist of a concrete reinforced box culvert, concrete footings, concrete top, stone abutments, concrete and steel bridge and abutments.

Cincinnati, O.—Bids are asked by County Commissioners, Fred Dreihs, Clerk, until noon, July 19, for the following county work: Under Specifications No. 609. For the building of a culvert on the Carmargo Pike; grading and metaling part of the pike, and removing iron superstructure over Little Duck Creek, Columbia Township.

Cleveland, O.—Bids are asked by County Commissioners, Julius C. Dorn, Clerk, until 11 a. m., Aug. 3, for the construction of bridge work per, Report No. 1606 Concrete Abutment, Strongsville Township. A. B. Lea, County Surveyor.

Jackson, O.—Bids will be received at the County Auditor's Office, Jackson, O., until 1 p. m., Aug. 5, for the construction of six concrete bridge structures. Plans on file at office of J. W. Turner, County Surveyor. Certified check for $100 required with bid.

Mount Gilead, O.—Bids are asked by Commissioners of Morrow County, until July 16, for labor and material for constructing superstructure of steel bridge over Whetstone Creek. W. C. McFarland, County Auditor.

Sidney, O.—Bids are asked by Commissioners of Shelby County, until noon, July 13, for constructing 80-ft. span high truss single track bridge, over Nine Mile Creek.

Buildings,

Items Arranged Alphabetically by States.

Yuma, Ariz.—Bids are asked by Board of School Trustees, O. C. Johnson, Clerk, until 10 a. m., July 29, for building a school house. Trost & Trost, Architects, El Paso, Tex.

San Dimas, Cal.—Bids are asked by W. M. Martin, Secretary School Trustees, until 1 p. m., July 15, for furnishing materials and labor and construction of an 8-room brick school building, on Cataract Ave. Ferdinand Davis, Architect, corner Second and Main, Pomona, Cal.

Washington, D. C.—Bids are asked by Francis H. Dushay, Chairman Building Committee, 1120 Vermont Ave., until 3 p. m., Aug. 1, for construction of one-family building at the Reform School.

Bishopville, Ga.—Bids are asked by R. W. McLendon, Chairman, Court House Commission, until noon, July 23, for constructing court house building for Lee County. Certified check for $3,000 required with bid.

Bringhurst, Ind.—Bids are asked by Advisory Board of Monroe Township at Bringhurst until 1 p. m., July 12, for the construction of a 4-room brick school building. James L. Crites, Trustee.

Fort Benjamin Harrison, Ind.—Bids are asked by Geo. H. Penrose, Q. M., until 10 a. m., July 17, for installing heating system in one civilian employe's quarters.

Franklin, Ind.—Bids are asked by Advisory Board of Hensley Township, Johnson County, at Franklin, Geo. W. Coleman, Trustee, until 2 p. m., July 20, for the construction of a new brick school house in District No. 10.

Franklin, Ind.—Bids are asked by Advisory Board of White River Township, Johnson County, at Franklin, until 2 p. m., July 22, for the construction of a graded school building. J. W. Richardson, Trustee.

Marion, Ind.—Bids are asked by J. W. Sanderson, Treasurer of the National Military Home, Marion, until July 25, for the construction of an additional hospital and bath house.

Newberry, Ind.—Bids are asked by Wm. Neff, Trustee at Newberry, until 1 p. m., July 20, for the construction of a high school building. Separate bids on heating will be received.

Syracuse, Ind.—Bids are asked by the School Trustees until 8 p. m., July 12, for the heating and ventilating of new school buildings. H. W. Buchholz is Secretary.

Vevay, Ind.—Bids are asked by James M. C. Scoke, President of the Vevay Bank. Will receive bids until July 16, for the construction of a 3-story bank, store and lodge building, estimated to cost $20,000.

Boston, Mass.—Bids are asked by Trustees of the Boston City Hospital, George H. Rowe, Superintendent, until noon, July 16, for electric wiring the East Boston Relief Station on Porter St., East Boston. Edward P. Dana, Architect, 112 Water St., Boston.

Potosi, Mo.—Bids are asked by County Court, Lewis A. Page, Presiding Judge, until July 27, for erection of a brick court house.

Hoboken, N. J.—Bids are asked by James H. Londrigan, City Clerk, until 8 p. m., July 24, for carpenter, plumbing and painting work for Second Precinct Police Station. Bids will also be received at same time for the carpenter, mason and plumbing work at Police Headquarters.

Newark, N. J.—Bids are asked by R. D. Argue, Secretary Board of Education, until 7:30 p. m., July 16, for installation of electric lighting apparatus in South 59th St. school house. Plans and specifications for the proposed work may be examined in the offices of the consulting engineers, Runyon & Carey, 122 Market St., Newark.

Brooklyn, N. Y.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., New York, until 11 a. m., July 15, for the general construction, etc., of new public school 93, on the southeast corner of Herkimer St. and New York Ave., Borough of Brooklyn. Security required is $100,000.

New York, N. Y.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., until 11 a. m., July 15, for the general construction, etc., of new public school 56, on corner of Elm St. and Orchard Ave., Richmond Hill, Borough of Queens. Security required is $90,000.

Buffalo, N. Y.—Bids are asked by Francis G. Ward, Commissioner Public Works, until 11 a. m., July 19, for doing the heating, ventilating, etc., required in the erection of a six-room brick addition to the present school building in District No. 54, located on the west side of Main St., near Leroy Ave.

Cortlandt, N. Y.—Bids are asked by Board of Water Supply, Thos. Hassett, Secretary, 299 Broadway, New York City, until 2 p. m., July 23, for the construction of a field office building, for division and section engineers in the employ of the Board of Water Supply, in the town of Cortlandt. The building is to be a 2-story and attic office building, 40 ft. 4 in. x 45 ft. 4 in., in plan, with concrete or stone foundations, fireproof concrete vault, frame superstructure, shingle roof, and steam heating, plumbing and electric lighting systems.

New York, N. Y.—Bids are asked by Armory Board, Hall of Records, Chambers and Centre Sts., until 2 p. m., July 15, for furnishing and installing electric lighting fixtures, etc., in Twelfth Regiment Armory, Borough of Manhattan. Security required is $5,000. Plans with the Architects, Robinson & Knust, 164 5th Ave.

Columbus, O.—Bids are asked by Carl E. Steeb, Secretary Board Trustees, Ohio State University, until noon, Aug. 6, for furnishing the materials and performing the labor for the erection of a woman's dormitory at the Ohio State University, in accordance with the plans and specifications prepared by Wilbur T. Mills and F. Kenyon Hayden, Architects associated, Columbus, on file in the office of the Auditor of State.

Pickens, S. C.—Bids are asked by County Supervisors, until July 20, for enlarging present court house at Pickens.

Roads and Streets

Items Arranged Alphabetically by States.

Boonville, Ind.—Bids are asked by Ray F. Cheny, County Auditor, until 2 p. m., Aug. 5, for improvement by grading, draining and paving and construction of roads three, four, five and six as described in the report of the viewers and engineer in the matter of Campbell Township. Estimated cost of work is $24,256.

Greensburg, Ind.—Bids are asked by Charles P. Johnson, Trustee of Jackson Township, Decatur County, at Greensburg, until 1 p. m., July 15, for the furnishing of stone by the perch and crushing same for repair of roads in said township; crusher furnished by township.

Richmond, Ind.—Bids are asked by Board of Public Works until 10 a. m., July 12, for the construction of cement sidewalks on North E St., cement sidewalks, gravel roadway, cement curbs, gutters, etc., on S. 22nd St.

Spencer, Ind.—Bids are asked by Commissioners of Owen County until 11 a. m., July 18, for the construction of a new macadamized road upon and along the county line road between Owen, Morgan and Putnam Counties. Plans on file with Geo. O. Mitten, County Auditor.

Des Moines, Ia.—Bids are asked by Board Public Works, until 11 a. m., July 30, for the following work: Constructing 4,438 lin. ft. Portland cement curb on West 5th St.; constructing 2,199 lin. ft. combined curb and gutter on 6th Ave.; constructing 1,410 lin. ft. Portland cement curb on East 1st St.; constructing 4,116 sq. yds vitrified block pavement on West 2nd St.

Shepherdsville, Ky.—Bids are asked by County Clerk, until 10 a. m., July 15, for putting rock on about seven miles of road in Bullitt County. Also for building about seven miles of turnpike in Bullitt County. Specifications can be seen in County Surveyor's Office in Shepherdsville, Ky. Each bid must be accompanied by certificate check for $500.

New Orleans, La.—Bids are asked by Chas. R. Kennedy, City Comptroller, until 1 p. m., July 15, for the following work: Repairing with square granite blocks Common St. from Magazine to Front St.; sub-surface drains, culvert, curbs and gutter bottoms and sidewalk pavements on North Prieur St., from Lafayette Ave. to St. Roch Ave.; paving with asphalt, North Prieur St., from Lafayette Ave. to St. Roch Ave.; repairing with square granite blocks Gravier St. from Camp to Delta St. in accordance with plans and specifications on file in the office of the City Engineer.

Hagerstown, Md.—Bids are asked by Luther Peterman, Clerk, Hagerstown, until July 30 for paving South Potomac St. from north side to West Baltimore St. to Locust Point with sheet asphalt.

St. Paul, Minn.—Bids are asked by Board Public Works, R. L. Gorman, Clerk, until 2 p. m., July 15, for the curbing of Grand Ave., from Victoria St. to Milton St., with Kettle River sandstone.

St Paul, Minn.—Bids are asked by County Commissioners, until 10 a. m., July 15, for macadamizing portion of Edgerton St. and grading and improving portion of Bald Eagle Lake Ave.

St. Paul, Minn.—Bids are asked by Board Public Works, R. L. Gorman, Clerk, until 2 p. m., July 18, for the grading of Matilda St., from Maryland St. to South St.

Muskegon, Mich.—Bids are asked by P. P. Misner, City Recorder, until noon, July 15, for labor and material for paving Western Ave., from Goodrich St. to the intersection of Ottawa St. paving, with asphalt macadam, and the necessary drainage sewers.

Kansas City, Mo.—Bids are reported asked by County Court, until July 31, for macadamizing 68th St. from Holmes St. to Troost Ave.

Irvington, N. J.—Bids are asked by M. Stockman, Town Clerk, until 8 p. m., July 16, for the grading of the following streets and avenues: 14th Ave., 15th Ave., Oak Ave., Coit St., Rosehill Pl., Normandy Pl., Berkshire Pl., Prospect Ave. from the Lehigh Valley R. R. to Normandy Park. Bids are also asked for flagging the sidewalks of a number of streets. E. R. Halsey, Town Engineer, 164 Market St., Newark, N. J.

Jersey City, N. J.—Bids are asked by Street and Water Commissioners, George T. Bouton, Clerk, until 2 p. m., July 15, for the following work: Improvement of Colgate St., 713 sq. yds. Belgian block paving, etc.; Graham St., 1,383 sq. yds. asphalt paving, etc.; Van Reypen St., 900 sq. yds. asphalt paving, etc.; Claremont Ave., 1,075 sq. yds. Belgian block paving; Grant Ave., 6,675 sq. yds, asphalt paving, 3,740 lin. ft. curbstone, 11,600 sq. ft. flagging, etc.

Brooklyn, N. Y.—Bids are asked by Bird S. Coler, Borough President, until 11 a. m., July 17, for the work under 11 contracts for street improvements. Largest contract calls for regulating and repaving with asphalt pavement on a concrete foundation the roadway of Halsey St., from Broadway to Knickerbocker Ave., the Engineer's estimate of the quantities being as follows: 5,120 sq. yds. of asphalt pavement, 30 sq. yds. of old stone pavement to be relaid, 1,020 cu. yds. of concrete, 3,640 lin. ft. of new curbstone, 2,500 lin. ft. of old curbstone to be reset, 1 noiseless cover and head, complete, for sewer manhole.

Brooklyn, N. Y.—Bids are asked by Park Board, 5th Ave. and 64th St., New York, until 3 p. m., July 18, for furnishing all the labor and materials necessary to complete and construct asphalt tile walks in Bedford, Bushwick, Fulton, Saratoga and Irving Square Parks, in the Borough of Brooklyn. Security required is $18,000. Plans may be seen and blank forms may be obtained at the office of the Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn.

Buffalo, N. Y.—Bids are asked by F. G. Ward, Commissioner Public Works, until 11 a. m., July 16, for the following work, separate bid being required for each street: Repaving Lewis St., 30 ft. wide; paving St. Joseph Ave., 28 ft. wide; repaving St. Johns Pl., 28 ft. wide; repaving Dearborn St., 30 ft. wide; paving Pascal St., 30 ft. wide; repaving Louisiana St., 42 ft. wide; repaving Metcalfe St., 28 ft. wide.

New York, N. Y.—Bids are asked by Louis F. Haffen, President Bronx Borough, 117th St. and 3rd Ave., until 11 a. m., July 16, for the work under seven contracts for street improvements. One contract calls for regulating, grading, building approaches and placing fences in Manida St., from Lafayette Ave. to Edgewater Road. The Engineer's estimate of the work being as follows: 65,000 cu. yds. of earth excavation, 3,400 cu. yds. of rock excavation, 400 cu. yds. of filling, 600 cu. yds. of dry rubble masonry in retaining walls, culverts and gutters. Bids are also asked for constructing the Traverse Road at Burnside Ave. in connection with the Grand Boulevard and Concourse, the security required being $30,000. Bids are likewise asked for constructing the Traverse Road at East 240th St., in connection with the Grand Boulevard and Concourse, the security required in this case being $50,000.

Cincinnati, O.—Bids are asked by County Commissioners, Fred Dreihs, Clerk, until noon, Aug. 2, for the following county work: Under Specifications No. 626—For improvement of Muddy Creek pike, from the Bridgetown pike to the Muddy Creek road, Green Township; under specifications 625, for improvement of New Richmond pike, from school house at California to the Clermont County line, Anderson Township. Certified check for $500 for each job required with bid.

Cincinnati, O.—Bids are asked by County Commissioners, Fred Dreihs, Clerk, until noon, July 26, for the following county work: Under Specification No. 621, for improvement of Colerain pike, from Cincinnati corporation line to north corporation line of Mt. Airy, Colerain Township; under specification 646, for the repair of road leading to Suspension Bridge over Whitewater River, Whitewater Township; under specifications 648, for improvement of Hamilton pike from North Bond road to South Corporation line of Mt. Healthy, Springfield Township; under specifications 651, for the improvement of the Harrison pike from East Miami road to State St., in Harrison, O., Whitewater, Colerain and Harrison Townships. Certified check for $500 for each job required with bid.

Jefferson, O.—State Highway Commissioner Huston, Columbus, O., is advertising a highway proposed under the new Ohio law, for letting at Jefferson, Ashtabula County, Ohio, July 30. Specifications will be mailed to contractors upon request.

Mount Gilead, O.—Bids are asked by W. C. McFarland, County Auditor, until noon, July 23, for labor and material for constructing Harper Fleming free turnpike, 4.19 miles long; also for constructing Canaan free turnpike, 4.69 miles long. Certified check for $500 for each road required with bid.

Wellsville, O.—Bids are asked by Board Public Service, until noon, July 18, for improvement of 6th St., the work including 4,350 sq. yds. of brick paving and 2,270 lin. ft. stone curbing. Bids are also asked for improving Riverside Ave., this work including 1,670 sq. yds. brick pavement, and 500 ft. stone curb. Jno. A. George & Sons, Engineers.

Youngstown, O.—Bids are asked by Board Public Service, W. H. McMillan, Clerk, until noon, July 19, for grading Garlick St. from Waldo St. to Tremont St.

East Pittsburg, Pa.—Bids are asked by H. C. Kleinhans, Chairman Street Committee, until 7:30 p. m., July 15, for the grading, paving, curbing and sewering of Howard St., and the grading, paving and curbing of the following streets: Center Ave., Grandview Ave., Sunnyside Ave. and Wood St. Harrop, Hopkins & Taylor, Borough Engineers, Lewis Block, Pittsburg.

Ingram, Pa.—Bids are asked by D. H. Hainer, Borough Clerk, until 5 p. m., July 15, for grading, curbing and paving Ingram Ave., the work including 1,215 cu. yds. grading, 1,681 lin. ft. curbing and 2,833 sq. yds. paving. James S. Haring, Borough Engineer.

Sewickley, Pa.—Bids are asked by Frederick T. Martin, Borough Engineer, 514 Broad St., Sewickley, until 4 p. m., July 17, for paving Centennial Ave., the work including 3,800 cu. yds. excavation, 9,655 sq. yds. vitrified fire brick, 550 lin. ft. new curb, 5,500 lin. ft. curb, redressed and reset.

Wilkesbarre, Pa.—Bids are asked by James M. Norris, County Controller, until noon, July 18, for constructing pavement of vitrified paving block on Broad St., in Hazle Township, Luzerne County, between the City of Hazleton and the Borough of West Hazleton.

Sharpsville, Pa.—Bids are asked by Borough Council, W. A. Graber, Borough Secretary, until 7 p. m., Aug. 6, for constructing 11,700 sq. yds. of vitrified block pavement on Main and Walnut Sts.

Memphis, Tenn.—Bids are asked by the Memphis Park Commission, F. G. Knight, Superintendent, until noon, July 12, for laying granolith sidewalks around Bickford Park, on Fourth, Fifth and Henry Sts.; also for combined curb and gutter on east side of Parkway, from Poplar Ave. south about 1,000 ft.

Bensalem, Pa.—Bids are asked by Supervisors of Bensalem Township, Bucks County, Pa., Vandegrifts Hotel Maud, P. O., until 2 p. m., July 15, for construction of 7367 lin. ft. of Bristol road, extending from Trevose road to the line dividing the townships of Bensalem and Southampton, in said township. Plans and specifications can be seen at the office of the Township Engineers, Ruddach & McCracken, 400 Leedom St., Jenkintown, Pa.

Ogden, Utah.—Bids are asked by City Recorder, until 8 p. m., July 15, for building curbs and gutters in curbing and guttering district No. 14, extension No. 1, being 27th St. from Quincy Ave. to Adams Ave. and from Washington Ave. to Wall Ave. A. F. Parker, City Engineer.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., July 16, for removing defective wooden sidewalks and replacing them with cement concrete sidewalks, in the 16th Ward. Certified check for $300 required with bid.

Sewers.

Items Arranged Alphabetically by States.

Oakland, Cal.—Bids are asked by Board of Public Works, Walter B. Fawcett, Secretary, until 10 a. m., July 24, for labor and materials for construction of following sewers: Concrete sewer in Second St.; concrete sewer in Webster St.; concrete sewer in Second St. from Washington St. to Market St.; concrete sewer in Grove St. Bond of $5,000 required for each sewer.

Washington, D. C.—Bids are asked by District Commissioners, until noon, July 15, for the construction of sewers. Forms, specifications and necessary information may be obtained at Room 43, District Bldg., Washington.

Cordele, Ga.—Bids are asked by Mayor and Council until 3 p. m., July 22, for labor and material, for the construction of a system of sanitary sewers. Work will embrace approximately nine miles of pipe sewers from 8-in. to 18-in. in diameter, 72 manholes and 25 automatic flush tanks. Plans, etc., at office of J. B. McCrary & Co., Consulting Engineers, Empire Bld., Atlanta, Ga., and S. C. Stallings, Resident Engineer, Cordele, Ga.

Des Moines, Ia.—Bids are asked by Board Public Works, until 11 a. m., July 30, for constructing 415 lin. ft. of 10 in. vitrified clay pipe sewer in W. 9th St.

Spencer, Ia.—Bids are asked by R. L. Taylor, City Clerk, until 8 p. m., July 19, for constructing two 8 in. vitrified pipe sewers, one 1,089 ft. long, the other 667 ft. long.

New Orleans, La.—Bids are asked by Sewerage and Water Board, F. S. Shields, Secretary, 602 Carondelet St., until 3 p. m., Sept. 11, for the construction of, approximately, 110 miles of sewers and appurtenances. The sewers will range in size from 8 to 27 ins., and in depth from 5 to 17 ft., and will include, approximately, 1,230 manholes and 443 flush tanks. The work will be divided into four contracts.

Iron River, Mich.—Bids are asked by Chas. A. Otto, Village Clerk, until 8 p. m., July 17, for labor and material for the construction of sewers in Main Sewer District No. 1. E. G. Bradbury and G. S. Shute, Engineers, 85 North High St., Columbus, O.

Albany, N. Y.—Bids are asked by Board of Contract and Supply, Isidore Wachsman, Clerk, until 3 p. m., July 15, for labor and materials for laying 18 in. vitrified stoneware pipe sewer in North 1st St. Bond in $250 required with bid.

New York, N. Y.—Bids are asked by Louis F. Haffen, President Bronx Borough, 177th St. and 3rd Ave., until 11 a. m., July 16, for the work under 11 contracts for constructing sewers in E. 180th and other streets, the work including 254 lin. ft. of pipe sewer, 24 in., 1,132 lin. ft. of pipe sewer, 18 in., 551 lin. ft. of pipe sewer, 15 in., 1,240 lin. ft. of pipe sewer, 12 in., 351 spurs for house connections, over and above the cost per linear foot of sewer, 31 manholes, complete, 6 receiving basins, complete, 4,625 cu. yds. of rock to be excavated and removed, etc.

Henderson, N. C.—Bids are asked by Town Commissioners, Henry T. Powell, Clerk, until 4 p. m., July 24, for constructing extension of sewer system, the work including about 1,200 lin. ft. of 12-in. pipe sewers. Town will furnish pipe, etc. Clifton Currin, Engineer, Henderson.

Wellsville, O.—Bids are asked by Board Public Service, until noon, July 18, for constructing 680 lin. ft. 8 in. sanitary sewers, two manholes and one flush tank. Jno. A. George & Sons, Engineers.

Youngstown, O.—Bids are asked by Board Public Service, W. H. McMillan, Clerk, until noon, July 19, for labor and materials for constructing sewers in parts of East Federal St. and Summit Ave.

Cresson, Pa.—Bids are asked by J. B. Rowlson, Clerk of Council, until noon, July 15, for the construction of a sewer system, to consist of 2,340 ft. of 24 in. pipe, 1,100 ft. of 18 in. pipe, 6,920 ft. of 12 in. pipe, 2,040 ft. of 8 in. pipe, 5 manholes and 13 fresh water inlets. All pipe and connections to be furnished by the borough. Plans and specifications can be seen at the office of the Burgess on Ashcroft Ave., Cresson, and at the office of borough engineer, Fred W. Hanburger, Ebensburg, Pa.

Philadelphia, Pa.—Bids are asked by George R. Stearns, Director Public Works, until noon, July 22, for work under Schedule A—Construction of sewers appurtenant to the abolishment of grade crossings along the line of the Philadelphia, Germantown & Norristown R. R., and the Richmond Branch of the Philadelphia & Reading Ry., contracts No. 101 to No. 107, inclusive. Specifications, etc., from Chief Engineer Bureau of Surveys, Grade Crossing Division, Room 767, City Hall. The estimated cost of the work is $250,000.

Aberdeen, Wash.—Bids are asked by P. F. Clark, City Clerk, until 5 p. m., July 24, for labor and material for construction of sewers in Sewer Districts C and D, according to plans and specifications on file in office of H. W. Troutman, City Engineer. Sewer consists of about five miles of vitrified clay sewer pipe from 6 in. to 24 inch, with the necessary manholes, flush-tanks, lampholes, wyes, etc.; the manholes to be of concrete; the flush-tanks to be of concrete, with the Miller Automatic Syphon.

Janesville, Wis.—Bids are asked by Street Assessment Committee, S. B. Heddles, Chairman, until 2 p. m., July 25, for constructing about 290 ft. of sewer on High St., and 1,580 ft. of sewer on South Second St.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., July 13, for constructing a square box sewer, resting on a pile foundation, having a timber bottom, concrete walls and reinforced concrete top, in and along the alley between blocks 69 and 70, in the Fifth Ward. Certified check for $2,000 required with bid.

Oshkosh, Wis.—Bids are asked by Board Public Works, until noon, July 20, for constructing sewer in portions of Graham St. and Sherman St.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., July 16, for constructing following sewers: Pipe sewer in 37th St., certified check for $240; pipe sewer in Pabst Ave., certified check for $350; brick and pipe sewer in Harrison St., certified check for $500; pipe sewer in Hadley St., certified check for $420; brick and pipe sewer in Pabst Ave., certified check for $1,800; brick and pipe sewer in Burleigh St., certified check for $540; pipe sewer in W. 24th St., certified check for $360; brick and pipe sewer in Brattle St., certified check for $350; pipe sewer in Fratney St., certified check for $180.

Water Supply

Items Arranged Alphabetically by States.

Decatur, Ill.—Bids are asked by Albert Leach, City Clerk, until 10 a. m., July 26, for furnishing labor and material for the construction of pumping station for the water works system of Decatur. Bids will be received for the construction of a pumping station, according to plans and specifications: (a) Using Bedford stone trimmings, as shown and specified; (b) Using Terra Cotta trimmings in place of Bedford stone, as specified; (c) And without either Bedford stone or Terra Cotta trimmings. Daniel W. Mead, Consulting Engineer, 738 First National Bank Bldg., Chicago, Ill.

Elizabeth, N. J.—Bids are asked by the Elizabethtown Water Co., 68 Broad St., Elizabeth, until 4 p. m., July 15, for laying about three miles of 36 in. water pipe. Certified check for $2,000 required.

New York, N. Y.—Bids are asked by John H. O'Brien, Commissioner Water Supply, Gas and Electricity, until 2 p. m., July 16, for hauling and laying water mains in West Farms Road and in Jennings, Manida and 178th Sts. Security required is $5,000.

Comfrey, Minn.—Bids are asked by W. B. Brooks, Village Recorder, until July 16, for erecting water works plant.

Burlington, Vt.—Bids are asked by Filtration Committee, J. W. Goodell, Secretary, 257 Pine St., until 2 p. m., July 22, for furnishing all labor and materials for the construction of a mechanical filter plant, complete with all appurtenances. The work includes a covered reinforced concrete coagulating basin of about 250,000 gallons capacity; four concrete filter tanks, each of a net area of filtering surface of 200 sq. ft.; and a clear water basin beneath the filters having a capacity of about 100,000 gallons, together with all appurtenances and piping connections to the neighboring water pumping station, low lift centrifugal pumps, wash water pumps, etc. Hering & Fuller, Engineers, 170 Broadway, New York.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., July 13, for laying a line of 8-in. cast iron fire pipe, from Third St. to Ninth St., in the Fourth Ward. Certified check for $150 required with bid.

Excavation—Earth and Rock

Items Arranged Alphabetically by States.

Boone, Ia.—Tile Drains.—Bids are asked by E. F. Jones, County Auditor, until 1 p. m., July 16, for labor and material for construction of County Drain No. 42, consisting of 6,368 ft., 6 in., 1,607 ft., 8 in., 2,100 ft., 10 in., 900 ft., 12 in., and 2,000 ft., 15-in. tile.

Marshalltown, Ia.—Drainage Ditch.—Bids are asked by the County Auditor, until Aug. 1, for the construction of a drainage ditch about eight miles long, the work being divided into five sections. Ditch is to be partly open and partly 16 in. to 30 in. tile.

Portland, Ind.—Levee.—Bids are asked by Commissioners of Jay County, at Portland, until 10 a. m., July 15, for the construction of a levee in Sec. 23, Wayne Township. W. Lea Smith is County Auditor.

Baltimore, Md.—Dredging.—Bids are asked by Board of Awards, until 11 a. m., July 17, for dredging. Specifications with O. F. Lackey, Harbor Engineer.

Boston, Mass.—Dredging.—Bids are asked by Harbor and Land Commissioners, State House, Boston, until 2 p. m., July 12, for dredging a channel in West Falmouth harbor in the town of Falmouth and an area in Nantucket harbor to increase the anchorage area near the wharves. The work includes 39,000 cu. yds. dredging. Frank W. Hodgdon, Chief Engineer.

Albany, N. Y.—Barge Canal Work.—Bids are asked by F. C. Stevens, Superintendent of Public Works, Capital, Albany, until noon, July 31, for the work under three contracts for improvement of State

Barge Canal as follow: Contract No. 12. Erie Canal—Sections 6 and 7. For the excavation of the canal, protection of its sides, construction of Lock No. 23 and appertaining structures; bridges, abutments and bridge approaches and other incidental details, between deep water at west end of Oneida lake, Sta. 2720, and Mosquito Point bridge over the Seneca River at the east end of Contract No. 5, Sta. 5074 Length of Contract, 43.73 miles. Sheets 1 to 119 inclusive. Contract No. 14. Erie Canal—Sections 1, 2 and 3. For dredging a channel in the Mohawk River between the west end of Contract No. 11, Station 305, and a point near upper Mohawk aqueduct, at Rexford Flats, Station 1046; for constructing Dam No. 2 below Crescent Aqueduct, Station 305; Dam No. 3 and Lock No. 7 above Vischer's Ferry, Station 839; Dam No. 9 and Lock No. 13 at Yosts, Station 2954; Dam No. 10 and Lock No. 14, at Canajoharie, Station 3370; Dam No. 11 and Lock No. 15, at Fort Plain, Station 3554; Retaining dam at Mindenville, Station 3865; highway changes; culverts, and incidental work appertaining thereto. Length of contract, 15.0 miles. Sheets 1 to 46 and 49 to 163 inclusive. Contract No. 35. Oswego Canal—Section 1. For excavating the canal and protecting its sides, constructing Locks Nos. 7 and 8, bulkheads, culverts, spillways and incidental details between 0.56 of a mile above Utica street bridge Station 1164+00, and the harbor line north of Bridge St. bridge, Station 1208+85, at Oswego, N. Y. Length of contract, 0.85 of a mile. Sheets 1 to 66 inclusive. Plans, etc., at the office of the Superintendent of Public Works, at Albany, N. Y.; at the office of the Assistant Superintendent of Public Works for the Middle Division, at Syracuse, N. Y.; at the office of the Assistant Superintendent of Public Works for the Western Division, at Rochester, N. Y., and at the Canal Office, Spaulding's Exchage, Buffalo, N. Y. Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment of the cost of producing them.

New York, N. Y.—Rock Excavation.—Bids are asked by Armory Board, Hall of Records, Chambers and Centre Sts., until 2 p. m., July 15, for excavation and removal of rock and other material from the site of the proposed armory for the Twenty-second Regiment Engineers, Fort Washington Ave., 168th and 169th Sts., Borough of Manhattan. Security required is $30,000.

Galveston, Tex.—Dredging.—Bids are asked by Capt. John C. Oakes, U. S. Engrs., until noon, July 31, for dredging inland waterway between Aransas Pass and Pass Cavallo and to mouth of Guadalupe River through San Antonio and Mission Bays. Dredging, snagging and removal of rafts, etc., in Guadalupe River, between its mouth and Victoria, Tex.

Henrietta, Tex.—Railroad Grading, etc.—Bids are asked by Southwestern Railway of Texas until July 15 for 32 miles of tracklaying, 800 ft. of bridging and 30 additional miles of grading in Clay and Archer Counties, Texas. Plans and specifications at office of W. S. James, Chief Engineer, Henrietta.

Miscellaneous

Items Arranged Alphabetically by States.

Washington, D. C.—Concrete Conduit.—Bids are asked by Maj. J. T. Crabbs, Q. M., Walter Reed Army General Hospital, Takoma Substation, Washington, D. C., until July 18 for constructing concrete conduit on reservation of Walter Reed Army General Hospital, approximately 1,000 ft. long, 8 ft. wide and 5 ft. high, in the clear, covered with re-enforced concrete slabs.

New Orleans, La.—Concrete Work.—Bids will be received at office of Alfred Hiller Co., Ltd., New Orleans, until July 15, for constructing concrete footings, including excavation and creosoted piling in place and concrete reinforced retaining walls.

Boston, Mass.—Subway Entrance.—Bids are asked by Boston Transit Commission, 15 Beacon St., until noon, July 18, for constructing entrances and exit at Winter St. for the Washington St. Tunnel.

Brookline, Mass.—Street Lighting.—Bids are asked by Board of Selectmen, until 4 p. m., July 15, for furnishing and operating in accordance with specifications on file with the Superintendent of Wires and Lights, 700 more or less gas mantle street lights and 200 more or less naphtha mantle street lights.

Charlestown, Mass. — Concrete Coal Pocket.—Bids are asked by George P. Carver, Engineer, 1111 Merchants Exchange Bldg., Boston, Mass., for a reinforced concrete coal pocket, 182 x 90 ft., 8,000 tons capacity, at Charlestown, Mass. Plans and specifications can be seen at the office of the Engineer.

Buffalo, N. Y.—Foundation Work.—Bids are asked by F. G. Ward, Commissioner Public Works, until 11 a. m., July 18, for the building of foundations for new water works pumping station, on lands between Jersey St., Porter Ave., the New York Central R. R. and Harbor Line, Buffalo, N. Y.

New York, N. Y.—Dams.—Bids are asked by Board of Water Supply, J. Waldo Smith, Chief Engineer, 299 Broadway, New York, until 2 p. m., Aug. 6, for the construction of the main dams for Ashokan reservoir near Brown's Station, in the towns of Olive and Marbletown, Ulster County, New York. The work includes removing steel pipes, when directed; control of stream flow, Olive Bridge dam; control of stream flow, Middle dike; 2,055,000 cu. yds. earth excavation; 425,000 cu. yds. rock excavation; 7,055,000 cu. yds. refilling and embanking; 210,000 cu. yds. soil for surface dressing; 1,100,000 bbls. Portland cement; 280,000 cu. yds. concrete masonry; 530,000 cu. yds. cyclopean masonry; 64,000 cu. yds. concrete blocks; 125,000 sq. ft. face dressing for concrete; 95,000 cu. yds. dry rubble paving; 929,000 lbs. cast and wrought iron, steel and bronze. Caring for and setting 900,000 lbs. of metal work furnished by the city; 200 acres clearing; 11,500 lin. ft. vitrified pipes not exceeding 10 inches in diameter; 10,000 lin. ft. vitrified pipes more than 10 inches and not exceeding 18 inches in diameter; 950 M. ft. B. M. timber and lumber.

Cleveland Heights, O.—Street Lighting.—Bids are asked by William G. Phare, Village Clerk, 204 American Trust Bldg., Cleveland, O., until noon, Aug. 6, for furnishing the material and labor necessary for the lighting of certain streets and roads on Euclid Heights Allotment in said village. Certified check for $100 required with bid.

Grove City, O.—Street Lighting.—Bids are reported asked by Wm. C. Merritt, City Clerk, until July 15, for street lighting for term of one year.

Henrietta, Tex.—Railroad Construction.—See under Bids Asked—Excavation—Earth and Rock.

Milford Haven, Va.—Riprap Jetties.—Bids are asked by Major Spencer Crosby, U. S. Engrs., 22d and K Sts., Washington, D. C., until July 29, for constructing riprap jetties in Occoquan, Nomini and Urbana creeks and Milford Haven, Va.

Fort Monroe, Va.—Track Work.—Bids are asked by Capt R. H. C. Kelton, Constructing Q. M., until noon, July 30, for reconstruction and extension of the railroad track at Fort Monroe.

Houghton, Mich.—Power House, Tunnel.—Bids are asked by F. W. McNair, President, until July 11, for the erection of a stone power house and for the construction of a concrete service tunnel on the grounds of the Michigan College of Mines at Houghton, Mich.

Racine, Wis.—Breakwaters.—Bids are asked by Mayor W. V. Judson, U. S. Engrs., Milwaukee, Wis., until 2 p. m., Aug. 2, for building crib breakwaters at Racine and Kenosha Harbors, Wis.

Materials, Machines, Supplies, Tools, Etc

Items Arranged Alphabetically by States.

Washington, D. C.—Chain, Wire Rope, etc.—Bids are asked by D. W. Ross, General Purchasing Officer, Isthmian Canal Commission, until 10:30 a. m., July 22, for furnishing buoys, swivels, chain, wire rope, boiler tubes, bolts, rivets, lag screws, Babbitt metal, differential blocks, helve hammer, cart wheels, etc.

Washington, D. C.—Wire.—Bids are asked by Elliott Woods, Superintendent U. S. Capitol Building and Grounds, until noon, July 20, for weather-proof and rubber covered electric wires for House of Representatives office building. Material to be delivered on reels at the building. Erection of same not included.

Fort Benjamin Harrison, Ind.—Troughs, etc.—Bids are asked by Geo. H. Penrose, Q. M., until 10 a. m., July 17, for watering troughs and picket lines.

Checotah, Ind. T.—Water Works Equipment.—Bids are asked by this city, until July 15, for the purchase of boilers, pumps, heaters, boiler-feed pumps, electrically-operated triplex pumps, automatic high-speed engines, hydrants and valves, cast-iron pipe. Specifications may be had from the O'Neil Engineering Co., Dallas, Tex.

Eufaula, Ind. T.—Pumps, Pipe, Etc.—Bids are asked by this city until July 16, for the purchase of boilers, pumps, heaters, boiler-feed pumps, hydrant and valves, cast-iron pipe and other water works material. Specifications may be had from O'Neil Engineering Co., Dallas, Tex.

New Orleans, La.—Track Bolts, Spikes, etc.—Bids are asked by Chas. R. Kennedy, City Comptroller, until 1 p. m., July 15, for furnishing the City of New Orleans with the following material for Public Belt Railroad purposes: Track bolts, spikes and nut locks, pine timber and planking, special crossings Nos. 1B, 2B, 3B, 4B, 5B and 6B.

Albany, N. Y.—Special Castings.—Bids are asked by Board of Contract and Supply, Isidore Wachsman, Clerk, until 3 p. m., July 15, for furnishing special castings for Quackenbush St. pumping station. Bond for $1,000 required with bid.

New York, N. Y.—Road Rollers.—Bids are asked by Louis F. Haffen, President Bronx Borough, 177th St. and 3rd Ave., until 11 a. m., July 16, for furnishing and delivering two steam road rollers to the Bureau of Highways; 2 double cylinder steam road rollers, Buffalo Pitts or equal (size 15 gross tons).

New York, N. Y.—Cable, Fire Alarm Supplies.—Bids are asked by Francis J. Lantry, Fire Commissioner, 157 E. 67th St., until 10:30 a. m., July 16, for furnishing and delivering 5,500 ft. of 16 conductor underground cable. Bids are also asked for furnishing and delivering supplies for the fire alarm telegraph for the volunteer system, Borough of Queens.

New York, N. Y.—Broken Stone.—Bids are asked by Louis F. Haffen, President Bronx Borough, 177th St. and 3rd Ave., until 11 a. m., July 16, for furnishing and delivering broken trap-rock, lime or native stone screenings to the Bureau of Highways as follows: 15,000 cu. yds. best quality 1½-in. broken stone, trap-rock, lime or native stone; 5,000 cu. yds best quality ½-in. screenings, trap-rock, lime or native stone.

Columbus, O.—Engine, Dynamo, etc.—Bids are asked by Board of Trustees of the Columbus State Hospital until noon, July 30, for furnishing the materials and performing the labor necessary to install complete an engine, dynamo, switchboard and feed wires in the power house, and for furnishing the materials and performing the labor necessary to complete the cement work in the basement of the main building, all at the Columbus State Hospital, according to plans and specifications on file with Dr. George Stockton, Superintendent of the Columbus State Hospital, and Frank L. Packard, Architect, Columbus, O.

Cleveland, O.—Garbage Cars.—Bids are asked by A. R. Callow, Secretary of the Board Public Service, No. 105 City Hall, until noon, July 18, for furnishing and delivering six steel, side dump, standard gauge cars, suitable for handling and transporting garbage.

Wilkesbarre, Pa. — Vitrified Paving Blocks.—Bids are asked by James M. Norris, County Controller, until 2 p. m., July 18, for furnishing and delivering vitrified paving block.

Commerce, Tex.—Water Works Equipment.—Bids are asked by this city, until July 18, for the purchase of boilers, pumps, heaters, boiler-feed pumps, deep-well pump, cast-iron pipe, hydrant and valves. Specifications may be had by addressing the O'Neil Engineering Co., Dallas, Tex.

Fort Monroe, Va.—Locomotive, Cars.—Bids are asked by Capt. R. H. C. Kelton, Q. M., until noon, July 30, for one 10-ton six-wheeled locomotive; two open 12-bench passenger cars and one double trucked flat car.

BIDS RECEIVED.

New York, N. Y.—Repairing Asphalt Pavement.—Bids as follow were received June 3, for furnishing the labor and materials required for repairing asphalt pavement on the North and East Rivers, together with all work incidental thereto: Sicilian Asphalt Paving Co., 41 Park Row, $163,200; Barber Asphalt Paving Co., 114 Liberty St., $163,200; Continental Asphalt Paving Co., 42 Broadway, $163,200; Uralde Asphalt Paving Co., 1 Broadway, $169,500.

New York, N. Y.—Subway.—Bids as follows were received June 13, for constructing part of rapid transit subway in Centre St., between Pearl St. and Park Row, (1) standing for subway proper and (2) for the pipe galleries: Williams Engineering & Contracting Co., 13-21 Park Row, (1) $1,250,000, (2) $7,500; Degnon Contracting Co., 60 Wall St., (1) $1,386,000, (2) $10,000; Patrick McGovern, Boston, Mass., (1) $1,257,000, (2) $10,000; Bradley Contracting Co., 153 E. 24th St., (1) $998,328, (2) $5,500.

New York, N. Y.—Ferry House.—Following bid was received June 5, for building ferry house between Whitehall and Broad Sts., East River: Snare & Triest Co., 143 Liberty St., $647,800.

New York, N. Y.—Subway.—Following bids were received June 13 for constructing portion of rapid transit subway in Delancey St., between the Bowery and Norfolk, (1) representing subway proper and (2) pipe gallery: Cranford Co., 52 9th Ave., Brooklyn, (1) $1,800,000, (2) $80,000; Degnon Contracting Co., 60 Wall St., (1) $1,530,000, (2) $175,000; Bradley Contracting Co., 54 E. 24th St., (1) $1,229,136, (2) $69,300; Patrick McGovern, Boston, Mass., (1) $1,595,000, (2) $75,000; Thomas Crimmins Contracting Co., 444 E. 69th St., (1) $1,374,649, (2) $91,120.

New York, N. Y.—Electric Equipment.—Bids as follows were received June 27 for work and material for the installation of electric equipment, elevators, lifts, book conveyors and pneumatic tubes, in the New York Public Library, Astor, Lenox and Tilden Foundations, Fifth Ave., 40th and 42nd Sts.: Jno. Pierce Co., 277 Broadway, $198,000; Tucker Electrical Construction Co., 35 South William St., $195,651; Peet & Powers, 225, 4th Ave., $228,000; Chas. L. Eidlitz & Co., 113 E. 22nd St., $234,684; Ries & O'Donovan, 1123 Broadway, $209,440; Harry Alexander, 20 W. 34th St., $186,000; Wiston Electric Co., New York, $181,449; Lord Electric Co., 213 W. 40th St., $173,891; Commercial Construction Co., 114 E. 28th St., $207,000.

New York, N. Y.—Heating and Ventilating.—Following bids were received June 24 for installing heating and ventilating apparatus for addition to and alterations in public school 39, on the corner of State St. and Roanoke Ave., Far Rockaway, Borough of Queens; all bidders from New York City: Frank Dobson, 319 East 53rd St., $37,750; Blake & Williams, 211 W. 20th St., $34,532; Gillis & Groghegan, 537 W. Broadway, $31,485; E. Rutzler & Co., 127 White St., $36,833; R. J. Sovereign & Co., 63, 5th Ave., $34,900.

CONTRACTS LET.

Items Arranged Alphabetically by States.

Birmingham, Ala.—Railroad Work.—Atlanta, Birmingham & Atlantic R. R. Co., Alex Bonnyman, Chief Engineer, has awarded contract to Lane Bros. Co. for building branch from Bessemer, Ala., to Mulgay, in Jefferson County, where the Birmingham Iron Co. is developing new coal mines. The road from Bessemer to Mulgay will be 14 miles long, 80 lb. rails will be used and all streams crossed by steel and concrete bridges.

Oakland, Cal.—Sewer Extension.—F. H. Dahnke has been awarded contract for extension of Pleasant Valley Ave. sewer at $3,098.

Rockford, Colo.—Irrigation Ditch.—Joe Hanawalt of Logansport, Ind., has been awarded a contract for the construction of an irrigating ditch 50 miles long near Rockford, Colo. Consideration, $140,000.

Hartford, Conn.—Sewers.—Sewer Contracts have been let as follows: Edgewood St. sewer, Hartford Paving & Construction Co., $1,374; Edgewood St. and Homestead Ave., Charles H. Slocum, $1,281.

Washington, D. C.—Sewer Work.—District Commissioners have awarded a contract to Warren F. Brenizer Co., of 2d and O Sts., S. E., for the construction of junction sections of the B. St. and New Jersey Ave. trunk sewers at 10th St. and at 17th St. and Virginia Ave. The connection at 10th St. is to cost $10,561, and at 17th St. $3,465.

Washington, D. C.—Concrete Bridge.—Contract for constructing concrete and steel bridge across the track of the Baltimore & Ohio R. R. Co., on the line of Monroe St. extended, Anacostia, has been awarded to James Jenkins Overn of the Hoffman Construction Co.

Cairo, Ill.—Filling Sewers.—Cairo Contracting & Dredging Co. has been awarded contract for filling on several streets at $19,383. Garner & Haynes at $9,376 were awarded contract for constructing sewers.

Chicago, Ill.—Paving.—The Metropolitan Engineering & Construction Co., Chicago, has been awarded a contract for paving about 10,000 sq. yds. in a system of streets in Ravenswood, a suburb of Chicago. Standard Asphalt & Rubber Co.'s Sarco brand of asphalt will be used.

Chicago, Ill.—Sewer.—McCarthy & Cleary have been awarded contract for constructing sewer in State St. from 39th to 55th St. The sewer will be built of brick and cement and from 6 to 8 ft. in diameter.

Decatur, Ill.—Sewers.—Lisle Hunt has been awarded contract for constructing two tile sewers at a total bid of $4,190.

Edwardsville, Ill.—Paving.—John Hamm, Litchfield, Ill., has been awarded contract for paving and guttering Vandalia and Hillsboro Sts. at a total bid of $45,439.

Joliet, Ill.—Sewers, Water Main.—Charles R. Spears is reported to have been awarded contract for constructing water main in North Chicago St., at $2,005. Same contractor is also reported to have been awarded contract for sewer in North Chicago St. at $5,895.

New Holland, Ill.—Water System.—G. A. Treutile has been awarded contract for putting in new water system here.

Ottawa, Ill.—Sewer.—Green & Sons, Appleton, Wis., have been awarded contract for constructing west side sewer improvement at $190,874.

Clinton, Ind.—Brick Paving.—Harris & Dorsey, Terre Haute, Ind., have been awarded contract for constructing five blocks of brick pavement on Main St., at $17,045.

Brazil, Ind.—Street Work.—Michaels & Minnick, Muncie, Ind., have been awarded contract for constructing cement sidewalk and brick pavement here.

Butler, Ind.—Sewer.—Breymann & O'Neill, Toledo, O., are stated to have been awarded contract for constructing 6,500 ft. of sewer in Main St. at $47,500.

Waterloo, Ia.—Sewers.—W. N. Dearborn, Cedar Rapids, Ia., has been awarded contract at $93,219 for constructing several miles of sewers here. His bid was as follows: 1,590 ft. 48-inch. concrete sewer, $6.50; 14,045 ft. 36-in. concrete sewer, $4; 340 ft. 33-in. pipe, $4.50; 4,970 ft. 30-in. pipe, $3.60; 900 ft. 24 in. pipe, $2.30; 340 ft. 18-in. pipe, $1.60; 1,310 ft. 15-in. pipe, $1.15; 1,320 ft. 12-in. pipe, 85c; 58 manholes, each, $30; 2 bulkheads, each, $150.

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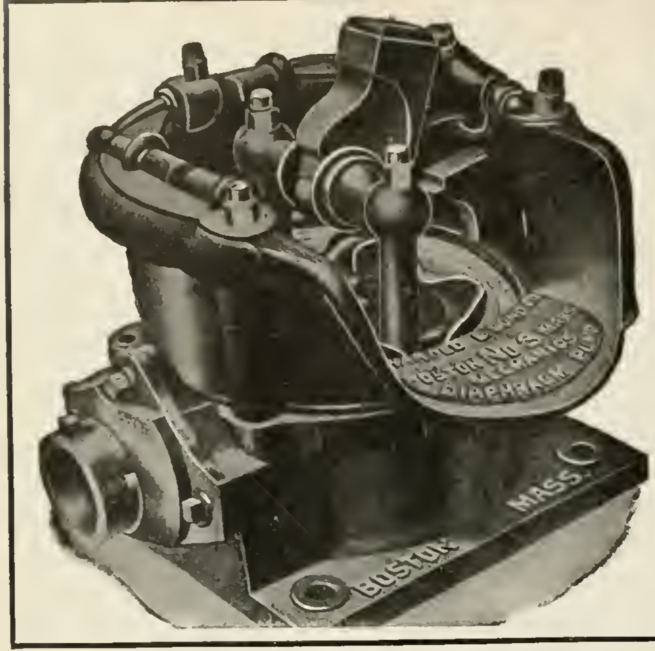

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CIVIL SERVICE EXAMINATIONS will be held at room 400, City Hall, Chicago, as follows: Mechanical and Electrical Engineers, grade 4, salary $1200 to $1400, July 22. Spelling, Penmanship, Arithmetic, Technical Knowledge and Experience. Open to residents of Chicago only. Mechanical Engineers, Board of Education, grade 10, salary $3000 or more, Sept. 28. Spelling, Penmanship, Arithmetic, Technical Knowledge and Experience. Residents of Chicago only. Architectural Draftsmen. Open to residents and non-residents of Chicago: Grade 5, salary $1400 to $1600, Oct. 1; grade 6 salary $1600 to $1800, Oct. 15; grade 4, salary $1200 to $1400, Oct. 30.

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Cost of Tunnel Lining.

Carefully worked out detailed costs of lining tunnels are scarce. It is with some satisfaction, therefore, that we publish in this issue the itemized cost of lining a single track railway tunnel in one of the far western states, in which the work was so recorded as to permit of a close analysis. We risk nothing in saying that this article is the most complete article of its kind ever printed, and it will pay every railway engineer to study it in detail. In making this study, however, and particularly in comparing the costs given with the cost of other tunnel lining work of which the reader may have records we wish to emphasize the caution given in the closing paragraphs of the article. In the tunnel described we have a record of unusually economical work; the lining was light in design and the work was very economically performed.

They That Live in Glass Houses.

Plans are being made, according to press reports, for a house to be built entirely of glass. This house, is is stated, is to be erected on Long Island, at a cost of $25,000, for a Wall street broker, who will seek sanitary perfection and all the health-giving qualities from sunlight shining through the roofs and walls as well as the windows of his residence. The house will be the size of a 15-room dwelling, but instead of having interior walls with hallways and doors, the two floors are to be divided off by means of Japanese screens of bamboo and paper as suits the occupant's fancy. Hollow glass blocks 12 in. long and 10 in. thick will be used in the construction of the house, and cream colored blocks will probably be chosen for the walls. An elaborate system of screens is to be devised to regulate the amount of sunlight. Electricity will be used for lighting and great care will be taken in installing the wiring and plumbing so that at night the house will not look like an X-ray photograph. As the glass will be tinted and therefore will not be transparent the owner of the house will not be obliged to follow the old maxim that "People who live in glass houses should pull down the shades."

The School Training of the Engineer as a Builder.

There is a growing demand on engineering educators to give more consideration to the training of engineers as builders in contradistinction to engineers as designers or investigators. This demand is coming from the students themselves as well as from engineers in practice. In the Cornell Civil Engineer for May, 1907, a students' publication, we find an editorial call for a course of lectures on cost keeping and estimating, and among the papers presented at the recent meeting of the Society for the Promotion of Engineering Education we note particularly one by Mr. Hugo Diemer, consulting engineer, on courses in industrial engineering. Mr. Diemer's remarks are so terse and to the point that we quote them here as follows:

"Any manufactured commodity before being put on the market must pass through the three distinct processes of designing, making and testing. Hitherto courses for educating mechanical engineers have concerned themselves primarily with the processes of designing and testing. The existing courses are admirably adapted to fit men for these processes. Our manufacturing industries have now passed beyond the pioneer stage, and while there is a continued proportional annual increased demand for men equipped to design and to test, there is a much greater demand for men equipped to deal successfully with the process of making. The relative economic value of these three processes may be illustrated by taking as an example the work of a company manufacturing mining locomotives. The pay-roll of the designing department in a well-known company engaged in this business was $20,000 per annum; that of its testing department was $5,000 per annum. In the making of the article, exclusive of the aforementioned departments, there was spent in labor alone, $500,000 per annum. The amount of money spent in making the machinery was 25 times as great as the amount expended in designing, and 100 times as great as the amount spent in testing. There were 500 men employed in the making as against 25 men engaged in the designing and 5 men engaged in the testing. Out of the 500 men employed in the making there were 75 engaged in supervisional and clerical work connected with the production department, and in no way connected with the commercial accounts, commercial correspondence, or sales. These figures are given as a typical illustration of the relative number of people affected and the relative amounts of money involved in production as compared with designing and testing. We are unconsciously limiting the field of the graduate engineer by imaginary barrier lines when we do not prepare him for the productive processes."

This argument is just as pertinent when applied to the civil engineering courses of the majority of our engineering schools. In these courses the great bulk, indeed, nearly all, of the student's time is devoted to training in designing and testing. The man whose task it is to work out the finished design in timber, masonry and metals receives from his college instruction very little specific training in the solution of his particular problems. Take for example the very important matter of cost keeping and estimating, few engineering schools if any at all give the student any specific training in the methods to be followed. In making a call for such a course, therefore, the student editors of the "Cornell Civil Engineer" are voicing a real want of the student body.

It is not our purpose here to discuss in detail the need for engineering school training in this special field or to outline the way in which this need can be satisfied. These matters were quite fully discussed in our issues of July 18 and 25, 1906. The arguments we made a year ago are even more forcible now, furthermore they are beginning to be understood and voiced by students and engineers. It is up to our engineering schools to give them most careful consideration.

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Cost of Lining a 4,000-ft. Tunnel With Concrete and in Part With Brick.

The following costs relate to the lining of a comparatively short single-track railway tunnel. For most of the distance it was lined with concrete side walls and concrete arch, but for part of the distance a brick arch was used instead of concrete. The brick was used only where it was necessary to support the roof by timbering, for wherever the roof would stand without props the concrete was used on account of its much greater cheapness.

The concrete side walls were 14 ft. high and had an average thickness of 2½ ft. Therefore each side wall averaged nearly 1.3 cu. yds. per lin. ft., and the two walls averaged 2.59 cu. yds. per lin. ft. of tunnel. The concrete was mixed 1:3:5, being, we believe, unnecessarily rich in cement. The average amount of concrete placed in the walls per day was 50 cu. yds.

Cost of Side Walls.

Materials:	Per cu. yd.
1.33 bbl. cement at $2.00	$2.66
0.5 cu. yd. sand at 0.18	0.09
0.75 cu. yd. stone at 0.55	0.41
Total	$3.16
Labor On Concrete:	
0.01 day foreman at $5.00	$0.05
0.03 day foreman at $3.00	0.09
0.03 day engineman at $3.00	0.09
0.35 day laborer at $1.75	0.61
0.42 Total	$0.84
Labor, Removing Timber, Building Forms, Excavating, Etc.:	
0.02 day foreman at $5.00	$0.10
0.05 day foreman at $3.00	0.15
0.40 day laborer at $1.75	0.70
0.47 Total	$0.95
Miscellaneous:	
0.02 day engineer and supt. at $5	$0.10
Falsework and forms, timber and iron	0.07
Tools, light, etc.	0.10
Interest and depreciation of $1,800 plant at 20% per annum	0.09
Train service, 0.03 day work train at $25	0.75

Summary Concrete Side Walls.

	Per Cu. Yd.
Materials	$3.16
Labor on concrete	0.84
Labor removing timber, etc.	0.95
Train service	0.75
Miscellaneous	0.34
Total	$6.04

In the two side walls there were 2.59 cu. yds. of concrete per lin. ft. of tunnel, hence the cost of the side walls was $6.04×2.59=$15.64 per lin. ft. of tunnel.

The concrete arch varied in thickness, averaging from 14 to 20 ins. at the springing line to 8 to 14 ins. at the crown. The arch averaged 1.2 cu. yds. per lin. ft. of tunnel. About 20 cu. yds. of arch were placed per day. The arch concrete was mixed 1:3:5 and the cost was as follows:

Cost of Concrete Arch.

Materials:	Per Cu. Yd.
1.36 bbls. cement, $2.00	$2.72
0.05 cu. yd. sand, 0.18	0.09
0.75 cu. yd. stone, 0.55	0.41
Total	$3.22
1.8 cu. yds. dry rock backing at 0.55	$0.99
Labor on Concrete:	
0.02 day foreman at $5.00	$0.10
0.12 day foreman at 3.00	0.36
0.88 day laborer at 1.75	1.54
1.02 Total 1.96	$2.00
Labor Placing 1.08 Cu. Yds. Rock Backing:	
0.01 day foreman at $5.00	$0.05
0.51 day foreman at 3.00	0.15
0.55 day laborer at 1.75	0.96
0.61 Total 1.90	$1.16
Labor Removing Timbers, Removing Forms, Excavation, Etc.:	
0.02 days foreman at $5.00	$0.10
0.04 days foreman at 3.00	0.12
0.06 day carpenter at 2.50	0.15
0.40 day laborer at 1.75	0.70
0.52 Total 2.06	$1.07
Train Service:	
0.06 day at $25	$1.50
Miscellaneous:	
Engineering and supt.	.07
Falsework, timber and iron	.13
Tools, light, etc.	.12
Interest and depreciation, $1,800 plant, 20% per annum	0.09

Summary Concrete Arch.

	Per Cu. Yd.
Concrete materials	$3.22
Dry rock backing (1.8 c. y.)	0.99
Labor and concrete	2.00
Labor placing 1.8 cu. yds. rock backing	1.16
Labor removing timber, etc.	1.07
Train service hauling materials	1.50
Engineering and supt.	0.07
Falsework, timber and iron	0.13
Tools, light, etc.	0.12
Interest and depreciation plant	0.09
Grand total	$10.35

It will be noted that the "train service" is an item that really should be considered as a part of the cost of the materials, for the cost of the sand and stone is the cost f. o. b. cars at the sand pit and at the quarry, to which should be added the cost of hauling them to the tunnel—to-wit, the "train service."

Summing up, we have the following as the cost per lineal foot for lining this single-track tunnel with concrete:

	Per Lin. Ft.
2.59 cu yds. side walls at $6.04	$15.64
1.20 cu. yds. arch at 10.33	12.40
3.79 cu. yds. Total $9.38	$28.04

It should be remembered that the higher cost of the arch concrete is due in large measure to the fact that 1.8 cu. yds. of dry rock packing above the arch is included in the cost of the concrete. Strictly speaking, this dry rock packing should not be charged against the arch concrete, and, segregating it, we have the following:

		Per Lin. Ft.
2.59 cu. yds. concrete side walls at	$6.04	$15.64
1.20 cu. yds. concrete arch at	8.18	9.82
2.16 cu. yds. dry rock at	0.55	1.19
Labor placing 2.16 cu. yds. at	0.64	1.39
Total		$28.04

This is a much more rational analysis of the cost and a still further reduction in the cost of the arch concrete might be made by prorating the train service item ($1.50 per cu. yd. concrete). At least half of this train service should be charged to the dry rock backing, for there are 1.25 cu. yds. of sand and broken stone to 1.80 cu. yds. of dry rock backing.

The amount of this dry rock backing, or packing, varies greatly in different parts of a tunnel. In the first half of this tunnel it averaged 1.8 cu. yds. per lin. ft., while in the second half it averaged nearly 2.4 cu. yds. per lin. ft. In a subsequent issue we shall give the cost of lining a tunnel that averaged 1.4 cu. yds. of dry rock packing per lin. ft.

As previously stated, part of this tunnel was arched with brick instead of concrete. About one-third of the tunnel was thus arched with brick, laid 2 to 5 rings thick, and averaging 1.28 cu. yds. per lin. ft. of tunnel.

The average progress was 13 lin. ft. per day. The brick were 2¼x4x8 ins. in size. The cost of the brick arch was as follows:

Materials:		Per Cu. Yd.
500 brick at	$7.00	$3.50
1.02 bbl. cement at	2.00	2.04
0.4 cu. yd. sand at	0.25	0.10
Total		$5.65
1.5 cu. yds. dry rock backing at	$0.55	$0.83
Labor and Masonry:		
0.03 day foreman at	$5.00	$0.15
0.03 day foreman at	3.00	0.09
0.32 day masons at	3.00	0.96
0.65 day laborers at	1.75	1.14
0.06 day sta. engr. at	3.50	0.21
1.09 days. Total	2.34	$2.55
Labor Removing Timbers, Moving Centers, Excavating, Etc.:		
0.02 day foreman at	$5.00	$0.10
0.07 day foreman at	3.00	0.21
0.07 day carpenter at	2.50	0.18
0.46 day laborer at	1.75	0.81
0.62 day. Total	2.10	$1.30
Labor Placing Rock Backing:		
0.01 day foreman at	$5.00	$0.05
0.06 day foreman at	3.00	0.18
0.52 day laborer at	1.75	0.91
0.59 day. Total	1.93	$1.14
Train Service:		
0.06 day at	$25.00	$1.50
Miscellaneous:		
Engineering and supt.		$0.04
Falsework, timber and iron		0.12
Tools, light, etc.		0.12
Interest and depreciation, $1,800 plant, 20% per annum		0.09
Total		$0.37

Summary of Brick Arch.

	Per Cu. Yd.
Materials for masonry	$5.64
Labor on masonry	2.55
Labor removing timber, etc.	1.30
Train service	1.50
Miscellaneous	0.35
Total	$11.24
Dry rock backing	0.83
Labor placing rock backing	1.14
Grand total	$13.21

The cost per lin. ft. of tunnel for lining with a brick arch resting on concrete side walls was as follows:

		Per Lin. Ft.
2.59 cu. yds. concrete side walls at	$6.04	$15.64
1.28 cu. yds. brick arch at	11.24	14.39
1.92 cu. yds. rock backing at	0.55	1.06
Labor placing 1.92 cu. yd. rock backing at	0.76	1.46
Total		$32.55

The previous remarks about train service apply in this case also.

Not much has ever been published on the cost of tunnel lining. Several examples of such cost are given in Gillette's "Rock Excavation," but the costs there given are considerably higher than those above recorded. In making comparisons, however, the reader is cautioned to compare the cost per cubic yard of lining as well as the cost per lineal foot of tunnel. The character of the ground and the opinion of the engineer influence the thickness of the lining used, so that one tunnel may contain twice as many cubic yards per lineal foot as another tunnel of equal size.

Masonry lining put in at the time of construction is obviously cheaper than lining put in to replace an old timber lining. Not only does the passage of trains delay work, but the cost of removing the old timber lining is no small item itself. The work above described involved the removal of an old timber lining, yet it was done at a very low cost, particularly when one considers that it was done by company forces and not by contract.

As for the methods used in removing the old timber lining in this tunnel and putting in the new masonry lining, a description of similar work is given on pages 339 and 340, Gillette's "Rock Excavation," which serves to describe the methods used in this case, although a much lighter lining was used in this case.

In a subsequent issue we shall describe in detail the lining of a long railway tunnel, giving the itemized cost. We shall welcome any contributions from our readers on tunnel excavation and lining.

During 1906 under the direction of the Board of Local Improvements of Chicago, Ill., 467 miles of sidewalks were constructed at a cost of $1,777,000. Of this aggregate 278 miles were cement sidewalks.

Concrete has been put to some strange uses. Recently it was successfully used to patch up the hull of a steamer which had run upon a rock and had sustained several holes in its iron hull. The largest hole was about 80 ft. from the bow and measured about 35 ft. in each direction, and through this gap came the rock, projecting for nearly 11 ft. into the hold. The salvage company managed to patch up this breach by means of concrete, and although leaks developed, the water was pumped out of the hold and the ship towed 40 miles to a dry dock.

Simple Tests of Portland Cement.[*]

BY W. PURVES TAYLOR.[†]

It is an unfortunate fact that tests of cement are rarely made by the average small consumer, although the work into which the cement enters may be fairly important, and failure of the construction through faulty materials may mean heavy loss of money and possibly of life. The quickly growing industry of concrete block making rarely employs tested cement, although poor cement will do far more damage to these blocks than to the heavy monoliths of large construction, the materials for which are most carefully inspected. The small consumer generally appreciates, to some extent at least, the importance of testing, but does not care to assume the annoyance and expense of employing a regular laboratory, and can find little that he can do himself or even understand in the elaborate standard methods of testing now so widely circulated.

The following simple tests are therefore given to meet this condition. These tests, of course, are by no means as accurate as those made by regular methods, but if regularly employed will ensure the user against any worthless material and will greatly enhance the value of his work. The tests are four in number—soundness, time of setting, purity and strength. The first two should be made of every shipment of cement received, while the latter need only be made from time to time as desired. The methods of making these tests are as follows:

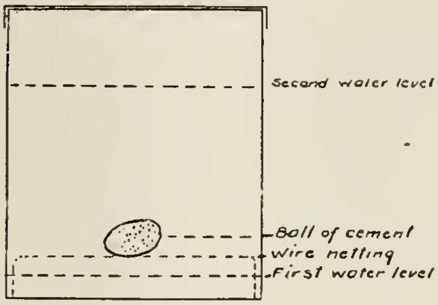

Fig. 1.

Soundness.—Take about half a pound of cement, place it on a clean surface of metal or glass and form it into a crater. Into the center of the crater pour about a fifth of its weight of water and mix thoroughly by hand or with a trowel for a couple of minutes until a stiff and uniform paste is obtained. Make a ball of the paste about 2 ins. in diameter and drop it on the table from a height of about 2 ft. If the ball flattens more than half its depth the paste is too wet; if it cracks badly it is too dry. Add more cement or more water, mix thoroughly and test until the right consistency is obtained, then mold two balls about 2 ins. in diameter.

Take a tin can, which has a tightly fitting cover and bend into it a piece of wire netting, as shown in Fig. 1, about 2 ins. from the bottom. Put about an inch of water into the bottom of the can, place one of the balls on the netting, cover the can and put it away in a cool place for 24 hours. Then fill the can with water to cover the ball, remove the cover and place it on a stove at such a heat that the water will boil in about half an hour. Let it boil gently for three hours. Have a second vessel of boiling water beside the can and as the water evaporates replace it with the boiling water. Never add cold water. After boiling three hours, remove the ball and examine it.

A good Portland cement will always pass this test and the ball will remain sound and hard. If the ball is disintegrated or if it is checked or cracked it generally indicates inferior quality and untrustworthy material. Sometimes failure in boiling is caused by the material being too fresh and a second test made a month or so later will pass, showing that the expansive elements have become hydrated and thus inert. In general, however, it is on the safe side never to use cement that fails in boiling. If it fails at first store it away for a month and then test again. If it still fails it is better not to use it.

Time of Setting.—Put the second ball made as previously described in a place protected from the sun or any other source of heat and from any strong current of air. At the end of 20 minutes examine it, then put it away and examine it again in ten hours. The ball at 20 minutes should be still soft and pliable, damp on the surface and should not feel warm. At ten hours it should be dry, firm and hard enough so that a firm pressure of the thumb nail will make no impression on it. If the cement begins to harden or feel warm in less than 20 minutes, it is generally inadvisable to use it, since setting will have begun before the mortar or concrete is molded and the result will be a weak and easily disintegrated product. It is, of course, possible to re-temper such cement and obtain excellent results, but this process requires considerable skill and experience and therefore is not usually to be recommended. Quick setting cement often becomes slow on a storage of a month or two, so that it is better to keep this material than to attempt to use it earlier at the risk of poor results. A cement that does not harden in ten hours may ultimately give good results, but the slow setting will much delay the progress of the work and may cause injury in removing the molds or striking the centers. Safe practice will require cement to set between the stated limits.

Purity.—Take as much cement as may be lifted on a five-cent piece and place it in a china or glass dish. Pour on it a mixture of one part of water and three parts of muriatic acid, using a quantity equal to about three times the volume of the cement. Pure Portland cement effervesces violently for a second or two, then forms a yellowish jelly. A continued effervescence shows adulteration with limestone or natural cement. Cinder or sand is shown in a sediment at the bottom of the jelly. The presence of slag is indicated by the characteristic putrid odor of hydrogen sulphide. Cement containing any of these adulterations should not be used.

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[*] Reprinted from the "Concrete Review" of the Association of American Portland Cement Manufacturers. The author discusses this same subject more in detail in his book on "Practical Cement Testing," published by The Myron C. Clark Pub. Co., 355 Dearborn St., Chicago.

[†] Engineer in charge Philadelphia Municipal Testing Laboratories.

Strength.—It is very difficult to determine the strength of a cement mortar by any simple method and obtain results of even approximate accuracy. The following, however, is probably the best of these methods:

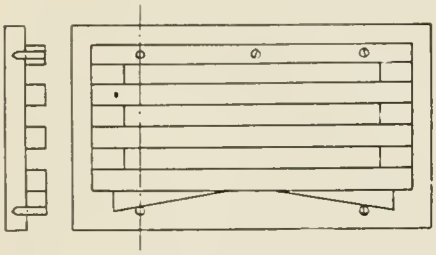

Fig. 2.

Make a mold, as shown in Fig. 2, of a planed board and some 1-in. strips of wood. Fasten the top strip to the board and place the others on loosely, holding them in place by the wedges at the bottom, thus forming molds for three prisms of mortar 1 in. by 1 in. by 12 ins. long. Take especial care that the cross sections of the prisms are exactly 1 in.

Take mortar from the mixing box or make some of one part cement and three parts sand, thoroughly mixed dry and then wetted to form a stiff mortar and fill the molds, pressing the material in firmly and smoothing the tops with a trowel. The molds should be oiled slightly to prevent the mortar from sticking. Put the mold away in a cool and, if possible, damp place for 24 hours, then remove the prisms of mortar and place them in fresh water, neither hot nor cold, for six or for twenty-seven days. Any prisms that are chipped or otherwise defective should be discarded.

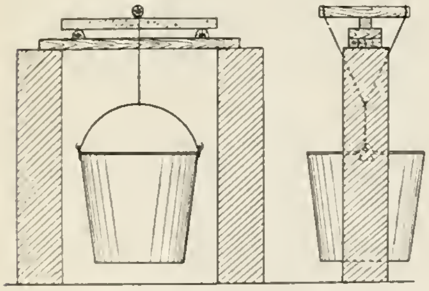

Fig. 3.

Make the apparatus shown in Fig. 3 with a board, a round piece of wood about one inch in diameter and a pail. The bottom knife edges are made by cutting the round piece of wood in half and are fastened to the board exactly 10 ins. apart, center to center. The center knife edge is a round piece of wood from which a pail is suspended by a cord.

When the test pieces are seven or 28 days old place them, still wet, on the apparatus as shown in the cut, taking care that the upper strip is exactly in the center and at right angles with the prism. Adjust the pail so that it is just off the ground and exactly under the specimen and then slowly pour sand into it until the prism breaks. Carefully weigh the bucket with the cord and strip still attached. If the prism is not exactly 1 in. square, correct the weight by dividing it by the product of its width times the square of its depth in inches.

The approximate strength of the mortar may then be computed as follows:

Tensile strength=Center load multiplied by 10.

Compressive strength=Center load multiplied by 50.

If the average of three prisms tested in this manner shows a tensile strength of less than 120 lbs. at seven days or 180 lbs at 28 days, for 1 :3 mortars, something is radically inferior and wrong with either the cement or the sand, and the fault should be thoroughly investigated.

Tests made by this method are, of course, far from being accurate, but they nevertheless give a very fair indication of the value of the material. In determining the relative value of different sands intended for use they will often give most valuable and useful information.

These tests described are, of course, crude in the extreme, but are vastly superior to no tests at all, and should be of much assistance to the small consumer in securing good material. Insist on cement that will boil and set normally and most of the dangers of inferior cement will be avoided.

Under the direction of the Board of Local Improvements of Chicago 87.51 miles of street pavement were laid in 1906 at a total cost of $3,300,000. This total of 87.51 miles included 48.07 miles of asphalt pavement, 31.32 miles of macadam, 4.56 miles of brick, 2.86 miles of granite block and 7-10 of a mile of creosoted block.

Extensive improvements are planned by the Japanese government for the harbor at Kobe. An expenditure of $1,972,080 for the work was approved last year and this year a further sum of $6,543,000 has been allotted. The work is to be begun immediately and is to be completed in 1914. The preliminary work will consist of filling in and reclaiming the foreshore, an area of about 60 acres, after which four piers are to be built, each measuring 1,200 ft. long and 360 ft. wide. In addition there will be 77 cranes for handling cargo and a line of railway 13 miles long, connecting the main line and warehouses. On the east side there is to be a breakwater of 2,130 ft.

Cost Keeping as an Aid in Managing Men.*

BY HALBERT P. GILLETTE.

It takes few men to design machines and structures, but it takes many men to superintend their operation. Therefore the great field of activity for the engineers of the future is in the field of operation rather than of design.

Until very recent years, engineers have rested satisfied with being the designers of labor saving appliances. But now they are beginning to assume the broader and more profitable function of operating the plants which their brains have created. To handle the ordinary industrial enterprise successfully involves: First, the application of engineering ability in selecting and improving the machines used; second, managerial ability in organizing the workmen, and in stimulating them to produce a large output economically; and, third, advertising ability to sell the product.

The man who combines in himself the maximum sum of these three abilties is the man best adapted to succeed as the executive of an industrial enterprise. Since the introduction of systems of cost-analysis and bonus payments for work done, engineers have become best qualified to act as managers of manufacturing plants. I include contracting and railroading among manufacturing industries, for the contractor manufactures structures, and the railroader manufactures transportation.

Why is it that engineers are better qualified as managers to-day than they were before the introduction of modern methods of cost-keeping and cost-analysis? I hope to answer this question in this paper.

Before cost-analysis had been developed to its present stage of excellence, the successful manager of men was usually one who had relied upon his lynx eyes and his knowledge of the weaknesses of human nature. He was often a man who owed his success largely to the fear he could inspire in his subordinates. He was domineering; he held his men to their tasks. He was, indeed, an industrial captain, and he used army discipline. He regarded every worker as a thief who would not hesitate at petty larceny of time even in the face of the foreman, and who delighted in grand larceny behind his back. His foremen were his spies, and he set himself to spy upon his foremen.

This was, in essence, the old method of management, which has existed since men gave up making a living by the chasing of beasts and began to make beasts of themselves by chasing one another. Literally this is true. It is degrading to have to stand over a man with a club to make him work—degrading to the man with the club and degrading to the man under the club.

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*A paper read at Seattle, Wash., before the Pacific North West Society of Engineers, April 6, 1907, and published in the Proceedings of the Society.

but more profitable to the man with the club.

Is it any wonder, then, that engineers, who had tasted the pleasures of science, preferred to be independent of all management as far as possible? And they have been largely independent, whether in the field as surveyors, or in the office as draftsmen and designers. They have felt neither the club from above nor have they wielded it upon others below. And I tell you, gentlemen, a few years of such freedom unfits most engineers to act as managers of men under the old system of industrial tyranny. This is one of the chief reasons why engineers used to be noted for their failures as contractors and as managers generally. I say "used to be," for they no longer are.

Within the past ten years I have seen one of my engineering friends after another work to the head of industrial enterprises, until I begin to wonder whether, in the course of the next ten years, there will be any engineers left to practice surveying, drafting and the design of structures. A short time ago I attended a reunion of my own class, and I found that more than half my classmates are engaged in manufacturing of one kind or another, and two are preaching the gospel, the latter thus demonstrating the versatility of an engineering training.

You all know many engineers at the head of successful contracting firms, and doubtless have felt a pride in the fact that engineers are winning their way in that most difficult kind of manufacturing—contracting. But I wonder whether the secret of the success of most of these engineers is also known to you. Of course I can not speak for all the engineers successful in contracting, but I have yet to find one who does not use a system of cost-keeping. I think that this is more than a mere coincidence. In fact, I have had many of these engineers tell me that their success as managers is due to their use of cost-keeping systems.

To most people, a cost-keeping system means nothing but a sort of bookkeeping, and they are unable to understand how a bookkeeper can develop into a successful manager. But the truth is that modern cost-keeping involves cost analysis, and cost analysis involves a study and comparison of the relative economy of men and of machines, and a study of relative economy leads to improvements, and improvements lead to commercial success.

Cost-keeping, in the sense that I use the term, has for its main object the determination of the efficiency of men. A proper system of cost-keeping tells you daily what each workman or each gang of workmen has accomplished. It is better than a foreman, for it can not "stand in" with the men. It is better than a foreman, for it costs you less and it tells you more. A cost-keeping system tells you who are your good men and who are your lazy men. It shows you whom to discharge and whom to promote. It tells you whose wages are too high and whose are not high enough. And, finally, it leads to that ideal condition of industrial organization known as profit sharing. How often have we read in novels of Utopias where all men share in the profits of all business; and how often have we smiled with incredulity at the prospect. Yet Utopia is right here in America, in spots, and it is a Utopia far more rational than that of the dreamers. I refer to those industrial Utopias where men are paid a bonus for all output over and above a prescribed amount. That is profit sharing, and it is a profit sharing begotten by the use of cost-keeping systems. For when a manager has learned, by cost-keeping, that certain men or groups of men produce more than others, he soon perceives the advantage of stimulating them to further use of brain and muscle by paying them a bonus for each unit produced in excess of a prescribed minimum. The men invariably respond to this stimulus, and often in a remarkable degree. It is nothing unusual for a man to increase his output 50 per cent upon the introduction of a bonus system of payment. Each man then becomes a contractor, and works with the zeal of a contractor, for his earnings increase as his energy and ability increase. This is a practical profit sharing that any workman can understand. It is not something vague and intangible, like 5 per cent per annum. It is something very real, for you can feel it in the pay envelope every week.

Cost-keeping, then, leads to better management by dispensing largely with submanagers. It substitutes the record card for the big stick, yet the record card itself is the biggest stick ever devised.

Now, for the benefit of those who have not hitherto given much thought to the subject of cost-keeping and cost analysis, I will outline a few fundamental principles to be used.

A proper system of cost-keeping shows the material used and the labor performed every working day—not every month, nor every week, but every day. The day is the unit of pay for work done, and it must be made the unit in measuring work accomplished, wherever the work is of such nature as to permit daily measurement. Often it is not practicable to make accurate daily measurements of work accomplished. Then it is usually possible to estimate, approximately, the output. For example, you may be unable readily to measure the yardage of concrete placed in a day, but you can record the number of sacks of cement used each day, and thus closely estimate the yardage of concrete. In devising methods of approximating the output, an engineer has a splendid chance to use his ingenuity and his engineering knowledge.

Not long ago a building contractor said to me that my theory of measuring daily output might work out all right in manufacturing and in contracting for engineering structures, but that it would never do for house erection. "How," said he, "would you estimate the number of feet board measure of studs, floor joists, and other rough lumber, placed in the frame of a cottage, day by day? Often when you see the building at night which you saw in the morning, you can hardly tell there has been any progress, and you couldn't possibly distinguish which sticks had been placed during the day from those which were put in the day before."

I had given this problem some thought, and I told him that, instead of attempting to measure what lumber was *in* the building, I would measure what was not in the building. By this I meant that I would provide stock piles for the lumber, piling each class by itself, and I would have a man measure or count each pile at the end of the day. The difference between the stock pile records on successive days would show what had gone into the building during the day.

This particular problem of cost-keeping on buildings is complicated, but it can be solved by any engineer who sets himself to the task. And to those engineers who solve it will come fortunes, for then one engineer can successfully manage the erection of a score of residences at one time where now it takes one contractor to every two or three small buildings, and generally results in uneconomic work at that.

Devising a method or methods of estimating daily output is fascinating to the engineer who loves problems in cost-keeping, and it is essentially the kind of work that an engineer enjoys.

Second only in importance to securing records of work done is the devising of ways that enable the manager quickly to compare results day by day. Here, again, the engineer is in his element. All engineers have been trained to depict mechanical measurements and formulas graphically by the aid of charts, diagrams and curves. Hence it is second nature for the engineer to plot a "cost curve," which shows at a glance the unit cost of each kind of work for each day or each week.

When a marked fluctuation occurs in the cost curve, indicating a rise or fall in the unit costs, then it is that the manager can usually visit the work to advantage. His very coming at such a time is itself a spur to the men, for they realize that he is keeping in constant touch with their progress, and immediately notices an increase or decrease in output.

The manager should be as liberal in praise as in condemnation, and he can usually be just in giving both, when he has a proper cost-keeping system to guide him.

Such a system as I am referring to is far different from the ordinary weekly or monthly report which seldom shows a trouble until it is too late to remove the cause of it. An illustration will serve to how the difference between the old method of cost-keeping and the new.

You are all familiar with the progress profile used on railway work. At the end of each month profile levels are run over the line of the partly excavated and partly filled sections. This progress profile is plotted on the regular profile and the area between the original ground profile and the new profile is tinted with some bright color, so that one can see approximately how much earth-work has been done during the month. To the area excavated the following month, another distinctive color is given, and so on for the succeeding months. A monthly estimate is made of quantities excavated, and the yardage may be written on the colored area. The railway engineer usually considers such a chart sufficient for his purpose, and the railway contractor often has even less to show him what portion of his work is completed at any given part of the line. He looks at his monthly payroll and he looks at his monthly estimate. According as one exceeds the other, he takes a sociable drink with the engineer, or a solitaire drink with himself. That is the old method of cost-keeping.

By the modern method the contractor receives a daily report of work done at every cut. In rock, the report shows the number of lineal feet of holes drilled, the pounds of explosives used, a chart of the location and depth of drill holes, car loads of rock hauled away, and such other details as are needed to determine both progress and economy of work done. Instead of the old progress profile, he has a mass diagram which indicates the total number of cubic yards in each cut, or in each group of cuts. On this mass diagram the amount of material removed each day is indicated, and, since the diagram is drawn to scale, the areas show at a glance the total work, the amount done to date, and the amount remaining to be done. On a large mass diagram of the whole excavation it is well to indicate the points that should be reached at the end of each week, if the contract is to be finished within the time limit.

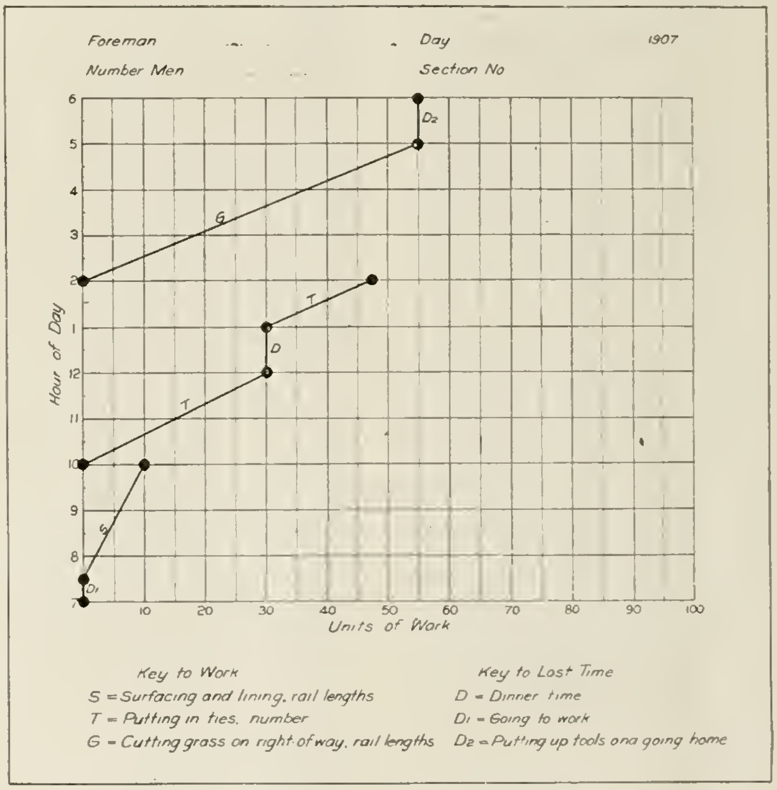
Similar mass diagrams show the yardage of masonry, and other diagrams are prepared for the quantities of other items in the contract.

Diagrams of this character possess two decided advantages over the tabulated reports from which they are prepared: First, they permit of quick comparisons of progress by days, by weeks and by months. Second, they insure that no reports are omitted or sent in incomplete. It is easy to overlook the omission of a certain daily report, when you are examining a pile of such reports, but on a diagram no such omission is possible. A diagram also enables one to detect errors in recording or calculating work.

Mass diagrams showing progress and cost curves showing unit costs enable a manager to locate trouble or laziness, and to check it at once.

In the prosecution of my present work of appraising the value of the railways of the State of Washington, I have gone through innumerable records of the cost of bridges, culverts, and other structures. It has been noteworthy that the cost of a very large percentage of structures has exceeded the engineers' estimates; and, in such cases, the engineer, or the superintendent, tries to explain the cause of the excess cost. The records show, in most cases, that neither of them knew what the cause was until after the work was finished. No better example could be found of the inefficiency resulting from a lack of the use of modern methods of cost-keeping. Indeed, I may go a step farther and say that practically all the railroads of our country are poorly managed in almost every department, simply because they cling to out of date methods of cost keeping. Usually, however, they pride themselves upon the completeness of their records, but, as compared with the methods of cost-keeping used by up to date manufacturers and contractors, the average railroad is in the kindergarten class. Occasionally you will find a division superintendent who occasionally has charts made showing the daily movement of freight trains over a division. But I know contractors who have similar charts made every day which show the movement of every wagon load to the nearest five minutes of time. They can tell you not only the distance traveled and the number of trips made by each wagon, but each delay and the cause thereof. Surely if it pays to watch the movement of wagons with such care, it will pay to watch the movement of trains in a similar manner, and to study and compare results with even greater care. Yet, so far as I can learn, the details of train movement are not ordinarily plotted and studied with anything like the minuteness which a cost-analysis engineer employs in managing the movement of dirt trains over a narrow gauge, temporary track.

For the purpose of indicating the degree of refinement of cost keeping which certain contractors employ, I present herewith a diagram which is susceptible of wide application. It is like the log of a ship, in that it shows the events of each day and the progress from hour to hour.



Proposed Record Card for Section Foremen.

The diagram is a proposed record card to be used by section foremen, and it shows the day's work done by a gang of section men. The vertical lines, or ordinates, show the hours of the day from 7 a. m. to 6 p. m. and the intermediate quarter hours. The horizontal lines, or abscissas, show the number of units of work accomplished. The black circles are holes punched with a conductor's punch. The lines connecting the punch holes can be ruled in after the day's work is done.

This particular card shows that the gang of men arrived at the site of the day's work and started in at 7:30 a. m. At 10 a. m. they had completed 10 units of work, and the key letter S on the straight line between 7:30 and 10 a. m. is found to be the number of rail lengths of track surfaced and lined. At 10 a. m. the gang began putting in ties, as is indicated by the key letter T on the straight line between 10 a. m. and 12 m. Then the curve of work rises vertically from 12 m. to 1 p. m., indicating that no work was done during the noon hour. From 1 to 2 p. m. the work of putting in ties was continued. At 2 p. m. the gang began cutting grass, as is indicated by the key letter G, and quit at 5 p. m., having cut grass for a distance of 55 rail lengths. Then the curve of work rises vertically from 5 to 0 p. m., and the key letter D shows that this hour was lost in picking up tools and going home.

It will be noted that a card of this sort gives a perfect log of the day's work, showing all delays, their cause and duration, and number of units of work accomplished. On the back of the card a series of key letters should be printed so that the foreman can indicate on the curve of work any kind of work done, and the units in which it is measured. The rail length is a convenient unit for certain classes of work, the distance between telegraph poles may serve for other classes. Incidentally, I may add, all telegraph poles on each section should be numbered consecutively. Then the foreman can be required to report the exact location of the work by putting the number of the pole on the curve of work diagram.

I venture to say that with a system of this sort, and by paying section men about 50 per cent more than is the present practice, it would be an easy matter for any engineer to increase the average output of section men by 100 per cent over present outputs.

The card shown herewith is obviously applicable to innumerable kinds of construction or manufacturing where men work as individuals or in gangs. It becomes complicated when a gang under a foreman is split up into smaller gangs which are continually shifted from one kind of work to another. But such shifting is usually unnecessary, and can be obviated, as a rule, by the use of better judgment in the management of the work. Indeed, this very objection to the use of such daily card reports points the way to better management by indicating the lack of reason for splitting gangs up into small units that putter away time.

I have said that there is a rapidly growing demand for engineers who can devise and apply a modern cost-keeping system. Indicative of this fact I may mention that within the last few months I have had many inquiries from very large contracting firms, as well as from engineering departments of the federal government, asking me to give them the names of competent cost-analysis engineers. These inquiries are coming in with increasing frequency, showing that the value of the services of a cost-analysis engineer are being recognized. Frequently, however, the salary offered would be no inducement to an engineer having a satisfactory position; but the chance for advancement in salary is infinitely greater than in the ordinary lines of engineering professional work. Moreover, the chance to become a partner in a firm is much better where a man is engaged in studying labor costs with a view to reducing them, than it is where he is engaged in studying designs with a view of saving materials. Few men are capable of judging the true worth of the engineer who saves money by an economic design of a bridge or by the economic location of a railway. But no man is so blind as not to be able to see the ability of the engineer who reduces the cost of excavating rock by 10 cents a cubic yard, or who effects an increase of 5 per cent in the tonnage hauled over a given division. Hence, it will always be more profitable to be a cost-analysis engineer than to be a designing engineer or a locating engineer.

I have used the term cost-analysis engineer in preference to cost keeping engineer, for the latter savors too much of bookkeeping. Whatever the term we use to designate the engineer whose specialty is the management of men by the aid of cost analysis, let us clearly understand that it takes originality, force of character, and all the arts of leadership to get the best results from a cost keeping system. No system will run itself. Success depends upon the man behind it. I believe that the best man to devise and apply a cost keeping system is one having the trained intellect of an engineer—the man to whom cost curves and progress diagrams do not seem to be things devised to make understanding difficult but to make it easy.

Now that there are so many engineers going into this new field of engineering activity, I wish to speak a word in behalf of the technical press. The editors of technical papers are always glad to publish methods devised for recording work and for increasing the economy of production. But, whether deterred by mere inertia or by a feeling that to be a writer is belittling to an engineer's reputation, it is a fact few civil engineers have ever written on the subject of cost keeping. Possibly there are fewer now engaged in such work than I think there are. But if any there are who hesitate to write because they fear to be regarded as writers rather than as doers of things, I would say that some of the ablest of doers have been able writers also. Ability in technical writing is not judged by the mere graceful flow of sentences, but by the skill as a reasoner which is displayed in the presentation of the subject. A shallow reasoner, or a mere copyist, can hope for no reputation from his writings, however frequent or voluminous they may be. On the other hand, a sound reasoner has nothing to lose and much to gain by writing. Nor should anyone offer lack of aptitude at writing as an excuse for not writing. Any man who can talk well can write well, and any man who knows his subject well can do both. A printing press is a phonograph for the brain, and printed pages are its records. Every cost analysis engineer should go on record at least once in his career, and there are those to whom a fortune will come as a result of having been heard by the world that once.

Some Costs of Excavating Earth With Wheel Scrapers and Portable Railway Dump Cars.

In excavating some 25,000 cu. yds. of earth for the construction of a railway siding for the Pennsylvania Railroad near Homewood, Pa., wheel scrapers and Koppel portable track and dump cars were used side by side. About two-thirds of the material were handled by the cars and the remainder by scrapers. From figures furnished us by the Arthur Koppel Co., Pittsburg, Pa., and compiled by Dodge & Day, Engineers, Philadelphia, Pa., we are able to give the following comparative records of the two methods of handling the material during one month when the conditions under which the car and scraper outfits worked were practically identical. The dates as recorded and furnished us do not permit of any exact analysis and comparison in detail, and they are given here as partial figures only.

Wheel Scraper Work.—The wheel scraper work was nearly all borrow pit work, the soil being good average earth, easily plowed with a three-horse grading plow. The haul was from 150 to 450 ft. and averaged 350 ft. No. 3 Western wheel scrapers were used, the number varying to suit the haul, and a 10-hour day was worked. The labor prices were as follows:

1 three-horse snap team at...........	$5.00
1 three-horse plow team at...........	7.50
1 foreman at	3.00
2 scraper loaders at	1.75
1 dumpman at	1.75
Two-horse scraper teams at...........	5.00

Table I shows the cost of wheel scraper work for a period of eight days. In this table the figures showing number of scraper loads, the cubic yards excavated and the total daily cost are those given by Messrs. Dodge & Day; the figures of average scraper load and cost per cubic yard have been computed. The column of average loads indicates that the total yardage was calculated by multiplying the number of scraper loads by 0.4 cu. yds., which, according to Gillette's "Hand Book of Cost Data," is about the average load "place measure" of No. 3 wheel scrapers.

Koppel Car Work.—The dump car work was in a wide cut and borrow pit; the average depth was about 5 ft. About one-third of the material was a hard, gravelly clay which could be plowed only by a three-horse rooter plow. All material waplowed and shoveled into the cars. The average shovel gang was four men to a car. Koppel 24 in. gage portable track was used, with the same firm's standard double side dump cars of 1 cu. yd. capacity each. The cars were operated in two trains of four cars each. The car dump was on a light trestle averaging about 20 ft. in height, constructed of round timber cut in the vicinity. The main track from the car dump led down into the pit with temporary spur tracks branching off over the bottom. Plowing was done on both sides of these spur tracks. The average haul was 650 ft. and a four-car train was easily handled by one horse. A 10-hour day was worked. The labor prices were as follows:

1 foreman at	$3.00
1 plow team at	7.50
1 one-horse team at	3.00
3 dumpmen at	1.65
Trackmen at	2.00
Laborers at	1.65

TABLE I—Showing Cost of Excavation by Wheel Scrapers and Plows for Railway Siding at Homewood, Pa.

Date.	Weather.	No. of Scraper Loads.	Total Cubic Yards.	Average Load Cu. Yds.	Total Cost.	Cost Per Cu. Yd.
Sept. 11.	Fair	352	141	0.401	$38.07	$0.270
Sept. 21.	Wet and muddy	352	141	0.401	38,07	0.270
Sept. 22.	Wet and muddy	576	230	0.399	60.70	0.263
Sept. 24.	Fair	572	229	0.401	50.84	0.222
Sept. 25.	Fair	528	211	0.399	59.74	0.283
Sept. 26.	Fair	580	232	0.400	56.04	0.241
Sept. 27.	Fair	473	189	0.399	44.07	0.233
Sept. 28.	Fair	473	189	0.399	57.18	0.302
Totals		3906	1562	.....	$404.71	.....
Averages		...	...	0.39975	.....	$0.26505*

*This figure is obtained by dividing the sum $2.084, of the figures in the last column, by eight, the number of items. By dividing the total yardage handled into the total cost we get $404.71 ÷ 1562 = $0.2584.

Table II shows the cost of the dump car work for a period of 15 days. In this table the costs per cubic yard have been computed and the other figures taken from the records furnished us. It may be noted here that these costs include the cost of building the trestle.

TABLE II.—Showing Cost of Excavation by Koppel Cars and Shoveling for Railway Siding at Homewood, Pa.

Date.	Weather.	No. of Train Loads.	Total Cubic Yards.	Average Load Cu. Yds.	Total Cost.	Cost Per Cu. Yd.
Sept. 11.	Fair	50	162	3.25	$42.70	$0.263
Sept. 12.	Fair	55	179	3.25	48.31	0.269
Sept. 13.	Showers	30	128	3.25	21.07	0.164
Sept. 14.	Very wet	62	200	3.25	41.48	0.207
Sept. 15.	Fair	58	189	3.25	41.16	0.217
Sept. 17.	Fair	70	227	3.25	50.61	0.223
Sept. 18.	Very hot	65	211	3.25	49.00	0.232
Sept. 19.	Very hot	73	237	3.25	51.17	0.216
Sept. 21.	Wet and muddy	48	156	3.25	56.12	0.359
Sept. 22.	Wet and muddy	48	156	3.25	55.16	0.353
Sept. 24.	Fair	57	185	3.25	44.63	0.241
Sept. 25.	Fair	68	170	2.50	43.19	0.254
Seut. 26.	Fair	72	180	2.50	46.18	0.256
Sept. 27	Fair	68	170	2.50	45.73	0.269
Sept. 28.	Fair	68	170	2.50	56.74	0.334
Totals and average		892	2720	....	$693.25	$0.2556

Note.—Referring to the costs of 35.9 cts. on Sept. 21 and of 35.3 cts. on Sept. 22, Messrs. Dodge & Day remark that "these were so much higher than the others that they tend to show some error in the foreman's report as turned in or else some unusually unfavorable conditions. For this reason it appears fairer to leave them out altogether."

The Emperor of Germany has granted provisional approval to the decision of the German Automobile Club to construct at Eilfel, Rhenish Prussia, a motocar race track 50 miles long and 30 ft. in width, to be laid out over valleys, hills and bridges and around sharp curves and with other difficulties in order to render the course as natural as possible.

A Brief Historical Account of the Development of Street Pavements, With Formula for Calculating the Cost of Maintenance.*

BY GEORGE M. TILLSON.†

Thirty years ago there was not a mile of pavement in existence such as is considered standard at the present time—it will therefore be of interest to study the causes which led to the use of the different materials in vogue at that time and also what led to the changes that have resulted in the adoption of the materials now in use.

It is said that the remains of an old road formed of broken stone have been found near the great pyramid in Egypt; this road was undoubtedly constructed for the purpose of carrying stone across the sandy desert for use in the construction of that pyramid. As this pyramid was built about 4000 B. C. this road is unquestionably the oldest one on record. When the Romans invaded Africa for the destruction of Carthage about 150 B. C. they found a well established road system which aided them very materially in the mobilization of their armies. The practical use of these roads evidently led them to construct others in their subsequent invasions in European countries, as wherever they went they left a large extent of well constructed roads. Pavements proper, however, were not very much in use until later times. Rome had its first pavements in the fourth and fifth centuries after the founding of the city, and the first pavements in Paris were laid in 1184, when the city already had a population of about 200,000. The Strand, London, was ordered paved by an act of parliament in the fourteenth century, when its population was 100,000. When it is considered that cities at the present time containing five or ten thousand people have a considerable amount of pavements, it must seem strange that these older cities existed so long with unimproved streets. The explanation of this is that besides their lack of civilization, there was very little traffic carried on by means of wagons, most of it being done by means of pack-horses and other beasts of burden. It is said that in the reign of Queen Elizabeth only 420 carts were allowed on the streets of London, the merchandise all being carried on pack-horses; and one hundred years later trains of pack-horses were regularly started from London to different parts of England. In 1625, in a population of 265,000, there were only twenty hackney coaches in use. All traveling in France was done on horseback until the latter part of the sixteenth century. In the city of Paris in 1550 there were only three carriages. The oldest pavements this generation has been able to see are those that have been disclosed by the excavation of the streets of Pompeii; the streets were narrow and the roadway was formed of large and irregularly shaped stones, laid flatwise. These pavements are in a good state of preservation and are fair samples of work of that character done 2,000 years ago.

As late as 1826 an engineer in London who had been investigating pavements on the continent wrote as follows: "Florence, Sienna, Milan and other Italian cities have pavements with specially prepared wheel tracks. These tracks are three feet in width, made of large and well laid stones. They are about four feet apart and the space between paved with smaller stones."

He also says these pavements as well as similar ones he saw in Rome are the best he has ever seen, but he adds that they are too expensive for London. When the relative importance of these cities and London at the present time are considered this statement is very interesting. As a rule the early pavements were made of large and irregularly shaped stones, laid flat and with very little care. As traffic increased, however, the necessity of better streets became apparent and the character of the pavement gradually improved. The stones were selected with more care and shaped roughly so as to make a smoother surface. In Italy the development took the line of large flat stones, oblong in shape, approximately two or three feet long and twelve or eighteen inches wide. Such stones could not, however, prove satisfactory and were not long used where the traffic was heavy. Some streets in Italy are paved with such stones at the present time. The well-known cobble stone was also used in the development of pavements. It came into very general use probably on account of its availability and cheapness. As the development continued it resulted in the formation of what is known as the Belgian block. These blocks were so called because first used in Belgium and were in shape practically cubical blocks. They make a very good and serviceable pavement, but are expensive. Following this came the oblong granite blocks such as are in use in our American cities at the present time.

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. The development of pavements in this country was practically the same as that in Europe, although very few of the large flat stones were used. Probably the first pavement laid in America was laid on a street in Pemaquid, on the coast of Maine, in 1626. This pavement has been unknown until recently, when it was discovered by a farmer who in ploughing up his field met with an obstruction. On investigation a well defined paved street was discovered and from the best information available it was thought that this must have been laid about 1626; the material was cobble stone. Cobble stone pavements were laid in New York and Boston practically at the same time, viz., 1656. In the early days of New York the Dutch built several breweries on the road lying between Broad and Whitehall streets, which has since been called Brower street. The brewery wagons created such a dust that the wives of the good burghers made complaints and finally the roadway was paved with stones. The street was then known as the stone street and it was visited as a curiosity by a great many people. Since that time the name has been changed to Stone street, by which it is known at the present time.

It is possible to trace the laying of pavements in the city of New York quite completely. Cobble stones were used entirely until 1849 as the regular material, although a few wooden blocks had been laid experimentally in lower Broadway in 1835. In 1849 Broadway was paved as far north as Franklin St. with what was known as Russ blocks. These blocks were from 2 to 3 ft. square and on grades were grooved in order to give better foothold for the horses. This pavement was relaid in 1868. In 1865 an experimental iron pavement was laid on Cortland St. This consisted of short cast-iron cylinders placed on end with the spaces between and the interior of the cylinders filled with gravel. Other similar pavements to this have been laid with the spaces filled with cement concrete. As might have been expected, this pavement was not satisfactory.

The so-called Belgian blocks were laid for the first time on the Bowery in 1852 and came into general use in 1859. They were supposed to be, and were, an improvement over the old cobble stone pavement. It was soon found they would not make a satisfactory pavement and in 1876 the present well-known granite blocks were used. What is known as the Guidet Patent Granite Blocks had been laid a few years previously. These blocks were practically the same as the granite blocks used today. Quite a quantity of this pavement was laid in Brooklyn in 1869 at a cost of about $7 per yard on a sand base. Although the patentee claimed royalty and brought suit against the city for the use of these blocks, the final decision of the court was against him and no royalty was recovered. The blocks were very large, some of them still remaining on one of the Brooklyn streets at the present time, being five to six inches wide and from eighteen to twenty inches long.

Asphalt in an experimental way was laid near the Battery in 1871. The condition of the New York pavements was such that a general scheme for their improvement was adopted in 1889, special legislation being obtained for issuing bonds for carrying out the work. From this time dates the beginning of the present improved pavements in New York city.

Cobble stones were used very largely in cities near the coast—Brooklyn, Philadelphia and Baltimore probably having the largest quantities. According to a bulletin issued in 1899 by the United States Department of Labor, Baltimore had 5,815,610 sq. yds. of cobble stone pavement, New York city 4,213,616 sq. yds. and Philadelphia 2,920,664 sq. yds. This amount has been reduced in Brooklyn to 78 miles, or about 160,000 sq. yds. (the other boroughs in New York city having practically no cobble stone pavements), and to 61.4 miles in Philadelphia.

In 1843 a committee of engineers was appointed by your own Franklin Institute for the purpose of investigating and reporting upon the best material to be used by the city of Philadelphia. After a careful examination this committee reported in favor of three kinds of pavements; the first to consist of dressed stone blocks, laid in diagonal courses, the blocks to be 8 in. deep, 7 to 9 ins. wide and 8 to 10 ins. long. This pavement was estimated to cost $3 per sq. yd. On streets of the second class the pavement was to consist of two stone tramways to accommodate traffic in both directions—the spaces between the trams and curbs to be paved with cobble. This pavement was estimated to cost $1 per sq. yd. The streets of the third class were to be paved with cobble stones. The committee reported as the best shape for the cobble stone: "They would be prolate spheroid generated by an ellipse of which the major axis is double the length of the minor." This report seems to have met with the fate of most such reports, as in 1884: forty-one years after its date 93 per cent of the entire pavements in Philadelphia were cobble stone, the entire length of the pavement being 535 miles. How closely the shape recommended by the committee was followed out in other cities is illustrated by a stone the speaker once measured in a Brooklyn street, which was 3 ft. 10 in. long by 11 in. wide and he never learned how deep.

Wood as a paving material seems to have been used in this country in cycles of 20 years. During the forties wood was adopted quite extensively in Philadelphia, New York and Boston. No particular attempt was made to select suitable kinds or lay it in any special manner and the result was what might have been anticipated, very unsatisfactory, and its use was soon discontinued. In the sixties the well-known Nicholson wood pavement was used to quite an extent throughout the country and for a few years gave quite satisfactory results, but the uneven decay and wear of the wood soon caused the pavement to become rough and it lost its popularity. In the eighties the cedar block pavement craze spread throughout the growing cities in the west and many million yards of this pavement were laid. It was only a makeshift pavement and in a comparatively few years was not seriously considered as a paving material and not used to any great extent except in Chicago. In the present decade the use of wood has again come to the front and it is not only being seriously considered, but has been generally adopted as a suitable paving material. It must be remembered, however, that it is a very different material from what has ever been used before, as not only the best quality of wood is selected, but it is treated chemically so that it will not decay, and the length of its life will depend upon the amount of traffic it sustains. This is the theory of the promoters and present experience seems to justify their claims. Wood has been used in the larger cities of Europe for quite a number of years and there it is generally untreated. Pine and deal wood are used as well as hard woods imported from Australia. The conditions in these cities, however, are different from those in American cities, as the traffic in London and Paris is such that the blocks wear out before they decay, so they do not require to be treated chemically.

Asphalt was first used in any great amount in Washington, when Pennsylvania Ave. was paved with it in 1876. The success of this pavement was such that it gradually grew into popularity; it is probable that during 1905 a greater mileage of this pavement was laid in the larger cities than that of any other kind. The accompanying table shows the changes in the character of the pavements in the cities of Brooklyn, Boston, Buffalo, Chicago, New York, Philadelphia, St. Louis and Washington. This table shows very plainly the popularity of asphalt as a paving material and also that of brick. It is undoubtedly true that if the smaller cities, in the middle west especially, had been used as examples, a much larger proportion of brick pavement would have been shown. A great deal of experimenting has been done in trying to secure good pavements and the best material with which to construct them.

In 1874 seventy-six patents had been issued by the government for constructing pavements of coal tar, asphalt and other bituminous material, and pavements more or less successful have been laid in this country and in Europe of wood, asphalt, coal tar, cement concrete, iron, brick, India rubber, shells, gravel, slag blocks and even glass and hay. At the present time the following pavements are considered standard: Asphalt, wood block, stone block, asphalt block, brick and bitulithic pavements. A large amount of macadam is being laid every year, but it cannot be considered a standard pavement.

Asphalt Pavements.—Asphalt pavements were first laid in the city of Paris, the first street being paved in 1854. These pavements were very popular in Paris, but were not entirely satisfactory on account of slipperiness. The European pavements were of a different character than those of this country. The former consist of asphaltic rock, which is taken from the mines, ground, then heated and transported to the street, where it is compressed by tamping and rolling so as to reproduce the original rock as nearly as possible. The stone containing the asphalt is lime stone and for that reason the pavement is slippery. The entire pavement must be transported from the mine to the plant and then to the street, so that the expense is comparatively large where the mines are a long distance from the streets to be paved.

The success of these European pavements, however, was such that experiments were made in this country in the sixties to reproduce if possible the European pavements or something equivalent thereto. The original bituminous pavements were made of coal tar, the first one probably in Brooklyn, in 1868. Washington laid a large amount of coal tar pavement, some of which is in existence to-day, having been down over 30 years. Coal tar, however, is not a stable or even material, and while some of these pavements were durable others disintegrated in one or two years, so that coal tar as a paving material lost caste and asphalt from the Island of Trinidad was used as a cementing material. These original coal tar pavements consisted of sand and gravel bound together with coal tar.

Asphalt is a hard natural bitumen found in nature. It is quite generally scattered over the earth's surface. It is formed from petroleum oil in nature's great distillery, requiring no one knows how long for its formation. It has been seen in California in every grade of its distillation from the crude oil to the hard asphalt. Asphalt is also produced by the artificial distillation of these California oils and when the work is carefully done the resulting product is satisfactory. The asphalt now in use comes principally from Venezuela, Trinidad and California.

In an asphalt pavement, asphalt itself forms only from 10 to 12 per cent of the entire pavement, the remainder being sand and stone dust. In almost every locality suitable sand can be found within a reasonable distance that would make cheap pavements, so that only 10 or 12 per cent of the entire pavements would have to be brought from a mine, thereby materially reducing the expense of the pavement to such an extent that European pavements cannot compete in cheapness with those laid according to the American methods. While not a perfect pavement by any means, asphalt appears on the whole to give the best sstisfaction for residence streets at the present time, and it seems bound to be a very important factor in street pavements for the future. It is comparatively noiseless, easily cleaned and its smooth surface is pleasing to the eye. One of its principal disadvantages is its slipperiness under certain conditions. If, however, the pavement is kept clean, there will not be much trouble on that account, as the pavement when wet is not as slippery as when it is simply damp. The matter on the surface of the pavement makes it slippery rather than its composition.

MILEAGE OF PAVEMENTS IN LEADING AMERICAN CITIES.

Character of Pavement.	Brooklyn.			Boston.			Buffalo.			Chicago.		
	1890	1900	1906	1890	1900	1906	1890	1900	1906	1890	1900	1906
Asphalt	10 85	68 82	263.48	4.65	13.80	21.16	106.03	222.74	228 71	9.24	78.60	271.43
Stone block	83 90	159.95	186.53	69.27	86.97	96.34	140.69	104.50	98.91	23.10	29.77	48.47
Cobble	289.21	236.85	78.40	5.95	1.01	0.30	......	......	......	......	......	......
Rubble	......	......	......	......	......	......	......	......	......	......	......	......
Brick	......	3 78	3.62	0.35	0.80	0.38	0.07	7 47	14 20	......	29.51	87.41
Macadam	2.81	78.57	99.81	204.57	280.57	337.10	3.28	3.08	11.90	227.01	363.40	490 54
Coal tar and concrete	......	......	......	BITULITHIC		5.00	......	......	......	......	......	......
Garnolithic	......	......	......	......	......	......	......	......	......	......	......	......
Slag block	......	......	......	......	......	......	......	......	......	......	......	......
Wood	......	......	2.16	......	......	0.91	......	......	......	410 29	763.21	581.18
Miscellaneous	......	......	......	GRAVEL		33.57	......	......	......	......	4.88	6.54
Total	386.77	547.97	634.00	284.79	383.15	494.76	250.07	337.79	353 72	669.64	1269.37	1485.57

Character of Pavement.	New York.			Philadelphia.			St. Louis.			Washington.		
	1890	1900	1906	1890	1900	1906	1890	1900	1906	1890	1900	1906
Asphalt	16.34	162 44	......	43.40	254.10	379.69	3.95	11.81	41.87	51.80	129.27	*160.81
Stone block	273.75	272 73	......	119.60	352.20	378.60	42 46	50.36	62.88	23.50	27.19	25.99
Cobble	3.33	1.10	......	375.10	69.20	61 40	......	......	......	11.50	11.31	9.68
Rubble	......	......	......	115.50	43.30	......	......	......	......	......	......	......
Brick	......	1.10	......	19.80	119.50	145.71	......	14.23	79 82	......	0.40	0.92
Macadam	24 23	113.12	......	88.80	193.50	273.34	290.08	351.92	BIT. 20.21	8.00	34.39	77.11
Coal tar and concrete	......	......	......	......	......	......	......	......	......	38.21	114.08	......
Garnolithic	......	......	......	......	12.80	12.77	......	......	......	......	......	......
Slag block	......	......	......	......	5.60	9 82	......	......	......	......	......	......
Wood	......	......	......	......	......	......	5.76	6.89	3.33	0 30	......	......
Miscellaneous	......	0.08	......	......	......	......	......	......	291.01	......	......	......
Total	317.65	550.57	......	762.20	1050.20	1261.33	341.75	435.21	499.12	133.31	216.64	274.51

*Includes coal tar.

TOTAL ASPHALT PAVEMENT.

1890	1906
229 92	1367.15

TOTAL BRICK PAVEMENT.

1890	1906
20.22	332.06

Asphalt Block Pavement.—Another form of asphalt pavement is constructed from blocks. The blocks were originally 4x5x12 ins. in size and laid on a gravel base. This made an expensive pavement and the blocks have gradually been reduced in size until now they are generally laid 3x5x12 ins. on concrete base with ½-in. cement mortar cushion. These blocks are made with a hydraulic press under pressure of about 5,000 lbs. per sq. in. They are used principally on grades and where the traffic is supposed to be too heavy for sheet asphalt. They make a good, durable pavement when the blocks themselves are good. It is obvious that poor blocks will not make a good pavement. Great care must be used in making blocks and a thorough knowledge of their manufacture should be had by anyone attempting to make them. Specifications for blocks have never been standardized or even made definite. They should be made of good substantial rock and so dense that they will not absorb an appreciable amount of water, and so strong that they will not break or crumble under traffic. The stone used should be trap rock as nearly cubical in form as possible and ranging in size from that which will pass through a ¼-in. hole to the fineness of dust and so graded as to have as few voids as possible. The asphaltic cement should be of such a character as to bind the particles of the stone together, and in amount should be about 6 to 8 per cent of the entire mass. Such a block should have a specific gravity of not less than 2.45 and if properly made should not absorb more than 1 per cent water when immersed for 24 hours. Asphalt blocks must necessarily be made at a central plant and transported from the plant to the street, so that they are somewhat more expensive than sheet asphalt. The pavement has increased in popularity from year to year and a great amount is constantly being laid.

Stone Block Pavement.—Stone block pavements of today are laid practically of granite blocks, but in Rochester, Buffalo and Cleveland the sand stone from the Medina quarries, in the western part of New York state, is used and is giving good satisfaction. The granite blocks are generally from 3½ to 4½ ins. wide, 7 to 8 ins. deep by 12 ins. long; the Medina blocks varying somewhat from this. The standard pavement is laid on a concrete base, the joints being filled with some impervious material. The custom in the vicinity of New York is to fill the joints with coarse gravel, the instertices of which are filled with coal tar. In some vicinities, however, cement grout is used for the filling both for granite and Medina sand stone. Tar and gravel were first used for filling joints in the pavements in London in 1869 and in Liverpool in 1872. Probably the first pavements of this character in this country were laid by the Dock Department of the city of New York in 1881. Stone pavements are laid where the traffic is heavy, and when laid as above described should last 25 to 30 years.

Brick Pavements.—Brick was first used as a paving material in this country in Charlestown, W. Va., in 1870. These bricks were laid on oak planks, which themselves were laid on a bed of sand. The pavement proved quite satisfactory and brick were gradually adopted in other cities in the vicinity. In the central west where natural paving material was scarce and expensive to obtain they have become very popular, the clays of Illinois and Ohio being especially adapted for paving brick. The bricks themselves have been laid in a number of ways according to the traffic to be sustained and the ideas of the controlling officials. A common practice under light traffic is to lay a course of brick flat, bedded in sand, and upon these lay the best brick on edge. The best method, however, is to use a concrete base and have the joints filled with some impervious material. This can be coal tar, asphalt or Portland cement. Considerable trouble has arisen in many cases where Portland cement has been used by the expansion of the pavement and the rumbling sound, caused probably by the lifting of the pavement from the concrete. It would seem strange that brick which must have been submitted to a temperature of 1,800 to 2,000 degrees F. should expand when laid in a pavement when the temperature of the air is but 120 to 125 degrees F., but such is a fact, and the practice today is whenever cement is used for the joints to have expansion joints of asphalt or some other bitumen every twenty-five or thirty feet across the street and longtitudinally against the curb. Brick pavements have not been used so much in the east as in the west, as the clays in the former section are not suitable for making paving brick and the expense of transporting them from the west is heavy. They make a smooth but a more noisy pavement than asphalt and in the east one that is more expensive. They have been used quite extensively in the smaller cities, but Philadelphia is the only large city in the east that has adopted them to any great extent.

Wood Pavements.—It may seem strange after what has been said that wood pavements should be considered a standard paving material, but when it is understood how different the present wood pavements are from those of the past the apparent paradox will be explained. The first wood pavements were laid of spruce or hemlock, the material taken without any special care and laid in an ordinary manner. With the Nicholson pavements both the character of the blocks and the manner of laying had been much improved, the blocks being of pine and laid on planks which themselves were placed on a sand cushion. The cedar block pavement laid in the west was simply formed of blocks 6 in. long cut from cedar posts, with the spaces between filled with tar and gravel.

Some seven or eight years ago the officials of Indianapolis in considering wood pavements decided that if treated wooden blocks would make a good pavement anywhere they would in Indianapolis. They therefore laid pavements, treating the blocks with creosote oil, the specifications calling for 10 lbs. to the cu. ft. These pavements were quite satisfactory, but swelled when being exposed to water and sometimes bulged considerably. This was undoubtedly caused from the fact that the blocks were imperfectly treated and the creosote itself was probably of an inferior character, as later pavements laid in the same way, but with more care, gave good results. It was found, however, that the creosote, being an extremely volatile material, evaporated and left the blocks porous and subject to moisture. The problem then was to hold the creosote in the wood so as to prevent absorption of the moisture and yet obtain the preservative properties of the oil. The block known as the Kreodone block was then made and used with good success in Indianapolis. This block was treated with creosote and some other more stable substance, probably an asphaltic substance, which prevented the volatilization of the oil and thus preserving the wood. In the east another form of treatment has been adopted quite extensively, which is known as the Creo-Resinate process. These blocks are treated with a compound made of one-half creosote oil and one-half resin, 20 lbs. to the cubic foot being injected into the blocks. The idea of the resin is to preserve the creosote in the blocks and so preserve the block itself from decay. A pavement of this kind was laid on Tremont street, Boston, some six years ago, and now shows almost no wear, although it has been subject to quite heavy traffic. There seems to be no question that this form of pavement will be extensively used in the near future. It has been laid during the past year on several of the heavy traffic business streets of New York.

The pavement for which wood blocks are specially adapted is for the paving of bridges on account of its durability and its lack of weight. A well treated block should have a specific gravity of a little more than one. These Creo-Resinate blocks have been used on the new Williamsburgh bridge across the East river and after having been in use for two years show very little wear. Some three years ago a small bridge in Brooklyn was paved with these blocks where the traffic was so heavy that ordinary planking wore out in some six or eight months; the present pavement is in fairly good condition now and would have shown very little wear had the foundation been even and solid, but it was laid on the old planks, which were uneven and shaky, so that the blocks soon broke into small pieces, but as pavement as a whole maintains its entirety. If the treatment of the blocks as described above will prevent all decay a pavement of this kind should last for many years on a resident street, and the proprietors of the pavement are prepared to apply it on the heaviest traffic streets. One great advantage of it is that it is the least noisy pavement of any in use. Its greatest disadvantage is its slipperiness. This pavement has cost in Brooklyn, having five years' guarantee, about $3 per sq. yd.

Macadam Pavements.—The macadam pavements are not standard and are too well known to require any detailed description. Their durability is governed wholly by the quality of the stone that is used in their construction. They are noiseless, easy for horses and cheap, but are extremely dusty, requiring constant sprinkling if they are to be kept in good condition. It would probably cost five or six cents per square yard per year to keep macadam pavements properly sprinkled, which is more than the average cost of asphalt in an ordinary good condition for total repairs. Attempt has been made to prevent dust on macadam pavements by treating the surface with coal tar. This has been quite satisfactory in many instances, but has not been tried sufficiently to afford basis for an intelligent opinion as to its durability. Another material for treating is known as Westrumite, a substance patented by a German named Westrum. This substance consists of asphalt, resin and some ammonia which is mixed with water and sprinkled on the street. The theory is that it will form a sort of gum and bind the dust together. This has been used somewhat during the past year, but not enough to show just how practical it is. Some time ago a contractor in the east who had been connected with the laying of asphalt pavements took up the problem of improving macadam with coal tar Strange as this may seem, instead of improving the macadam his labors resulted in the development of an entirely new pavement known as the Bitulithic pavement.

The Bitulithic Pavement.—This pavement was first introduced in the year 1901 in Pawtucket, R. I., on Park place, having a 3 per cent grade, and on Harvey street, having a 12 per cent grade. It is made of crushed stone and bitumen, the particles of stone being mixed in certain scientifically predetermined proportions as to sizes so as to provide a maximum of density and minimum of voids, so that the resulting bituminous concrete pavement is nearly as dense as a block of solid stone, with a surface that offers as little resistance to traction as asphalt, but one that is not slippery, because the fine stone used in the finish course provides a gritty surface similar to macadam, which affords secure footing for horses at all seasons.

The sub-grade for the Bitulithic is prepared as for other pavements and the foundation may be either bituminous or hydraulic concrete, depending on the character and solidity of the sub-soil. The concrete foundation is prepared as for asphalt except that when used with the Bitulithic wearing surface it is roughened by tamping crushed stone into the surface before the mortar has set so as to provide a bond and prevent the surface from rolling or creeping.

The bituminous foundation consists of broken stone or slag from two to three inches in size, laid to a depth sufficient to meet the demands of the traffic to which the proposed street may be subjected, usually from four to six inches. The broken stone is then thoroughly sompressed with 15-ton road rollers. Over this compressed foundation is spread a coating of heavy bituminous cement, or binder, which serves to firmly unite the foundation and wearing surface.

The wearing surface, after thorough compression, consists of two inches of the hardest broken stone available, varying in sizes from one or one and one-half inches down to an impalpable powder, the various sizes of the smaller stone, sand and impalpable powder being provided to fill the spaces between the larger stones. The proportions of the various sizes of material used are predetermined by physical tests with a view to obtaining the smallest percentage of air spaces or voids in the mineral mixture, and vary with the character and size of stone used in each particular case. After the proportions have been determined the crushed stone is passed through a rotary dryer and is then mechanically screened and separated into six sizes. The proper proportion by actual weight of each of these sizes is run into a mixer and there combined with a bituminous cement, which is also accurately weighed in the proper proportion. After being thoroughly mixed, and each particle of the mineral aggregate properly coated, it is hauled to the street, spread and thoroughly compressed with heavy steam rollers.

While the compressed Bitulithic surface is still warm, a flush coat of quick drying bituminous cement is applied, thoroughly sealing it and filling all pores in the surface, thus preventing the penetration of moisture. There is then applied a thin layer of hot, finely crushed stone, varying in size from one-fourth to three-fourths inch in size, according to the degree of roughness desired in the surface. The pavement is again thoroughly rolled and the street is finished and at once ready for traffic.

The Bitulithic pavement has been laid in 102 cities in the United States and Canada, ranging in climatic conditions from Glace Bay, Nova Scotia, to Shreveport, La., and from Portland, Oregon, to Atlanta, Ga., to the extent of over 4,000,000 sq. yds.—about 200 miles of street 30 ft. wide. It has been subjected to all classes of traffic in these varied climatic conditions and has successfully met the requirements in each case.

The different kinds of pavements having been considered, the next problem is the adopting of the one best suited for any particular street. An attempt has been made to study the properties of the different pavement materials so that they can be applied intelligently to any street when exact conditions are known. The following table gives the result of this study:

Characteristics for a Perfect Pavement.	Percentage.	Granite A.	Granite B.	Asphalt.	Brick.	Belgian.	Macadam.	Cobblestone.
Cheapness	14	2	4	4	3	5	7	14
Durability	21	21	17	15	13	17	7	15
Easiness of cleaning	15	11	8	15	12	7	5	2
Light resistance to traffic	15	7	6	15	12	6	6	4
Non-slipperiness	7	6	5	3	6	3	7	5
Ease of maintenance	10	10	7	6	6	7	3	2
Favorableness to travel	5	3	2	5	4	2	5	0
Sanitariness	13	9	7	13	11	5	5	2
Total	100	69	56	76	67	52	45	44

In this table the characteristics of a perfect pavement are given in the first column and in the second the different values of each characteristic. The following columns show the values for the different kinds of pavements. Granite A is a granite block pavement, laid on a 6-inch concrete base with tar and gravel joints. Granite B is the same pavement, but laid on sand with sand joints. As the table was made some years ago, wood does not appear, but the different materials illustrate the principles of its operation.

The application of the above table can be illustrated in several ways.

Assume, for instance, a street over which the traffic must be heavy and continuous. Ultimate cost is of great importance. It overrules first cost. Light resistance to traffic and foothold for horses are ruling elements, so that a given power may move its maximum load. The items first to be studied are, then, durability, maintenance, traction and the non-slippery property. Consulting the table and combining the values of these items, granite A has a value of 44; granite B, 35; asphalt, 40; brick, 37; Belgian, 33; macadam, 23, and cobble stone, 26.

Consider next a residential street, built up with homes whose owners have means sufficient to afford the best of anything they desire, and, while not wishing to be extravagant, do want and expect the best pavement that can be laid without regard to expense. This is an entirely different proposition. Cost, durability and maintenance, so important before, can be left out of consideration altogether. Easiness of cleaning, non-slipperiness, favorableness to travel and sanitariness are the governing characteristics. Working as before, granite A has 29; granite B, 22; asphalt, 36; brick, 33; Belgian, 18; macadam, 12, and cobble, 9. Asphalt, possessing all the desired properties in so high a degree, should be selected without much question.

It is also important to know just what each pavement will cost after it has been laid. Let C equal the cost per square yard, I equal rate of interest to be paid, N equal the life of pavement, R equal the total cost of repairs and A the amount to be paid in each year to create a sinking fund to equal C in N years.

$$A + CI + \frac{R}{N} = \text{annual expense.}$$

For granite A: C=$2.50;
I= .035;
R= .60—an amount sufficient to relay the pavement once during life:
A= .064;
N=25 years.

Substituting in the equation.

$$\$0.06425 + .0875 + \frac{0.60}{25} = \$0.17575 \text{ for first period.}$$

For the second period, assuming the value of the concrete to be $0.70 per square yard, making the cost of relaying $1.80 per yard, the annual expense is found as before to be $0.13326, or for fifty years an average of $0.154.

In this way the actual cost of a permanent pavement of any kind can be determined.

It is often desirable to know positively when the cost of repairing a pavement has become so great that it would be economical to relay the pavement. This can be determined by the same formula, as its result governs the cost of maintaining the pavement perpetually, so that when the annual repairs equal or exceed the perpetual annual cost, it is time to repave.

Take for instance an asphalt pavement and let N equal 15 years, C equal 1.50, I equal 3½ and R equal 0.40. Then A will equal .0807 and the equation becomes

$0.0807+.0525+.0267=$0.1599; or if the street be repaved it will cost annually $0.16 till it is renewed. Consequently if the life of asphalt be correctly assumed at 15 years, it should not be repaved until the annual cost approaches $0.16 per square yard. Assuming the life to be 20 instead of 15 years and applying the formula as before, the annual cost will be reduced to $0.1356 per yard.

The author believes this is the true scientific way in which to determine when an asphalt pavement, from an economical standpoint, should be relaid.

Methods and Costs; Some Old, Some New.

Repairing Leaks in a Rivited Steel Pipe.—Two holes, averaging ¼ in. in diameter, were caused by corrosion in a 38-in. riveted steel pipe. The leaks were repaired by first closing the hole with a wooden plug, then covering it with a patch of sheet lead and a steel patch held in place by heavy iron bands or clamps passing around the pipe, after which the outside edges of the lead were calked.

Hand Mixed Concrete.—In the construction of a reinforced concrete arch, a considerable part of the concrete was mixed by hand, the method of doing this being as follows: A single board was employed about 25 ft. long, and placed so that it sloped slightly from one end to the other. Sixteen mixers were employed, eight on each side of the board. The ingredients were dumped on the upper end of the board and the first two mixers turned the material dry; next to them stood a man with water which he applied after every shovelful. The next mixers kept turning the material along and another waterman assisted in wetting the mixture further down the line. In this way the whole mass was moved along by a sort of continuous motion and when the end of the board was reached the concrete was shoveled directly into the carts below. Each batch contained about 18 cu. ft. and the rate of mixing was about 10 cu. yds. per hour.

Soundings for Bridge Sites.—The following apparatus was used in making soundings to determine the character of the foundations required for a bridge over a medium sized stream. The sounding rod consisted of a 1-in. gas pipe in sections 10 ft. long, each end of a section having welded to it a 6-in. piece of ¾-in. gas pipe so that the end projected ⅞ in. This end was threaded on the outside and the sections were connected by an ordinary ¾-in. union 1⅝ ins. long, threaded inside. The drill used was a 1-in. rod, 12 ft. long and pointed like an ordinary rock drill, with its cutting edge widened to 2 ins., 1 in. back from point and tapering back to shank. This shank was drawn out to ¾ in. and threaded to fit an ordinary union. A couple of holes were provided near the bottom end of the pipe attached to the drill to relieve the air pressure in lifting in a sticky hole. The sounding rod and bit were used as an ordinary churn drill. The soundings were made by a party consisting of a foreman and three men provided with the sounding rod and drill noted above, two pipe wrenches, two rod clamps for raising rod, two water pails, one axe and one spoon. The rod clamps were pieces of iron similar in shape to an ordinary wrench and made to fit the pipe snugly so that when a lever is put under the handle end the clamps will jamb the pipe.

Repairing Broken Force Main.—A 16-in. force main crossing a stream below a stone bridge was broken at that point by one of the cap stones of the bridge falling upon it. The pipe was not completely covered with earth and its top could be seen through the water. The piece broken out of the pipe was about 5 ft. long. About 3 ft. of water was found to be flowing over the main, and as it would have taken too much time to build a cofferdam and pump out the water another method of repairing the break was resorted to. By this method the pipe was uncovered for some 40 ft. on each side of the break. A large derrick was then brought and erected over the pipe on one side of the break, and after three joints of pipe had been uncovered and the partially broken length in the water had been entirely cut by dynamiting, the end of the broken main on the south side of the stream was raised by the derrick, assisted by four jacks placed by the side of the pipe. The broken end was raised over 3 ft., clearing the stream, in about 30 minutes. The main on the north side of the stream was raised in the same manner, the lead joints giving sufficiently so that no damage was done to the main. While the broken pipe was being taken from the joints a bridge had been thrown across the stream, the north end of the broken pipe was then jacked up and moved about 1 ft. and the sound end moved about 1 ft. in the opposite direction. A new 12-ft. length was then rolled into place, and the two ends of the old pipe brought back into line. Lead joints were made and the pressure turned on, and with some slight calking of the other joints all were found as good as before the break. The entire job, including transportation of men and material 2½ miles, was completed in less than 24 hours. The work was done under the superivision of C. W. Wiles, Delaware, O., and was described by him in a paper before the American Water Works Association.

Constructing Engine Foundation.—A 6,000,000-gallon capacity, horizontal cross-compound pumping engine is supported on a pile and concrete foundation. The construction of this foundation offered some difficulties owing to the nature of the soil on which it was constructed and to the proximity of a battery of boilers and stack. The soil was a quicksand covered with 3 ft. of dry clay and loam and 7 ft. of fill. The boiler and stack foundations go down to the water line 10 ft. below grade. To cut off the piles for the pump foundation below the ground water level and to place a mass of concrete around their upper ends to form a footing necessitated the excavation of the quicksand to a total depth of 15 ft. below grade and 5 ft. below the water line. The method of doing this so as to cause no settlement of the stack or boilers was as follows: An open pit was excavated to the water line and in it was placed an open box 4 ft. high and 16x40 ft., the full size of the proposed footing. A floor was laid inside the box and 90 12-in. holes cut in 14 longitudinal and seven transverse rows. A 12-in. vertical wrought iron pipe 4 ft. long, open at both ends, was fitted into each hole. Concrete was placed in the box up to the top of the pipes, and after it had set, pig iron was piled between the pipes to give additional weight. The men then commenced simultaneously at either end and the center of the box to bore the quicksand under it by means of post-hole augers. These augers were each operated by two men who worked back and forth from end to end of the transverse row of holes, boring through each pipe to a depth of 1 ft. below the bottom of the box. After borings had been made in all the pipes it was found that quicksand had filled them to the level of the bottom of the box. The borings were repeated and as the quicksand was removed the box descended, care being taken to keep the loading and the borings uniform. After the box had reached the required position piles 11 in. to 12 in. in diameter at the top and 8 in. at the point were driven through the pipes to a distance of 19 ft. below the top of the box and cut off level with the top of the pipes. The pipes were then grouted, the caisson filled with concrete and the second course of concrete built above it in the usual way.

The Council of Ministers of Russia has authorized an annual expenditure of $15,500,000 from 1908 to 1911 for the construction of new warships and their armaments.

During 1907-8 the government of India proposes to raise a loan of $30,000,000 to be expended on railways and irrigation works.

The Isthmian Canal Dams in the Light of the Wachusetts Dam Landslip.

BY LINDON W. BATES.

On April 11, without a warning symptom, a dam-slip, little short of a disaster, occurred at the north dike of the Wachusett reservoir of the Metropolitan Water Works of Boston. At the highest point of the embankment, a section, some 675 ft. long, and approximately 100,000 cu. yds. in volume subsided and slid from its place into the water leaving the earth core exposed.

The reservoir dike is of recent construction. It was designed to withstand, at this short section, 65 ft. of water. On the date of the collapse it had but 41.7 ft. of head, and this was the highest gauge that had ever yet been admitted. The level lacked, therefore, 23.3 ft. of the height for which "with unprecedented margin of safety" according to its designer, this embankment was built. In other words, the reservoir was less than two-thirds full, when one-seventh of the crucial volume and section performing the ordinary functions of a dam, went down. It subsided and shot out with sufficient momentum to send its rock facing, its gravel, part of the earth ridge and earth core, several hundred feet, in almost a moment. The local journal giving the report says: "Suddenly there was a rumbling, and the noise of huge rocks falling together, and the whole construction of the dike trembled, as if shaken by an earthquake. The hole that is made in the big bank is a monster, and it is well worth a trip to view what nature can in a moment do to put at naught the efforts of man." Nature did indeed smite here a few complacencies, when, in the providence of God, before the water had reached nearly its destined height, she repudiated thus forcefully the engineering illusions, and took back her own. Had the reservoir been full, and thus all the unstable and fateful mass under the crest saturated, would anything have diverted from lower Clinton and the valley below, the fate of Johnstown? Would they not have joined Galveston, St. Pierre, San Francisco and Kingston in the growing list of great disasters? The gratulations that weaknesses and faulty designing brought a reckoning to but 675 ft. out of the two miles of embankment, are as quaintly audacious as they are specious and misleading, since a visit to the locality shows that this section immediately at the sag or outlet of Sandy Pond, is the only part of the embankment which had against it any water at all. Except at the sag, the reservoir, less than two-thirds full, made no trial whatsoever in any way or degree of this earth dam, and the water owing to the natural configuration of the ground had no more chance for an escape than has the swan boat lake in Central Park. At the sag, however, there was a chance for failure, and here two slides did befall under the partial head.

The smaller or south slip occurred where there was but a few feet of water against the face. This trivial amount even, was enough to melt the slope like sugar and let the gravel facing and berm slide away. The second break beginning a couple of hundred feet north of this with a little natural peninsula intervening, extends in a broken curve, half-moon shaped with a nearly vertical cliff-like bank. The chord to the arc is 675 feet long. In the bank standing, back of the cave, there are in two places cracks, and the fall of further small masses is imminent. The subsidence and slip extends the whole width of the sag or outlet, of the old pond. Right here was the only place calling for what one would seriously deem a dam. The lake reservoir has been lowered about a foot below the critical level, since the misfortune. Though being two-thirds full, it shows numerous low islands and knolls. In only two places did the waters even touch the toe of the slope in this work of engineering art, and except at these two places, the edge of the water is from fifty to several hundred feet distant from it, with stretches of bare, sandy flats, stripped of vegetation, and from 2 to 6 ft. above water, intervening. The dike is all, except at the sag, a mere rip-rapped levee. It never elsewhere, even when full, would have had against it over 20 ft. or so of water,—half the depth that presses against thousands of miles of levees, unknown to fame.

Examining the detailed plans, specifications and works of execution at this reservoir, one notes that they reflect two dominant ideas, one an invention, the other a specialist's concept and exemplification of the Hazen formula, of through and underdam percolation, together with unique ideas touching the selection and distribution of materials for an earth dam, their slopes and loads.

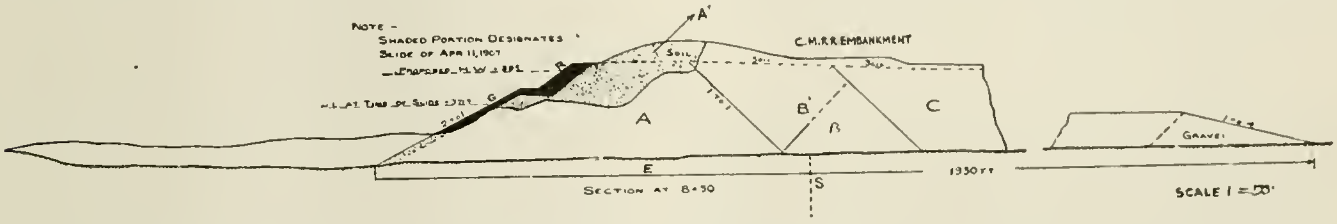
To the invention per se (a method of setting sheet piling in panels to depths of 50 or 60 ft., where favorable material permits), we record the free and open homage always due to a successful expedient. The sheet-piling is extended, however, not only under the short dip, but under all the rest of the long embankment, which as was said, will never have more than 20 ft. or so of pressure. Equally, across the long plateaus and at the trough of the old pond, a great trench was dug where possible, 60 ft. deep, and the patent sheet-piling was driven in the bottom another 50 or 60 ft. If ever the engineers of the Boston Water Supply should dominate the construction of the levee system on the Mississippi river it would take the national and state treasuries to pay for the thousands of miles of 60 ft. trenches and sheet piling which they would install; for the river dikes have to meet double the head pressing on most of the Wachusett construction.

There was a little gap, however, that at the old pond neck, about 675 ft. across. The earth dam here was to hold back water to the depth or head of 65 ft. This situation was "met" in a special design and construction, with which its creator was so content that he planned its immortality. He was gone with two other similarly eminent specialists to sit as final judge and jury upon their own so much challenged plan for Panama. They, of course, reported anew their designs as pre-eminently safe and certain, though at the identical hour the vaunted justification for the Isthmian dams, the dike was making public mockery of the pretense. Its highest and only important section under the advancing saturation lost cohesion, overbore friction, and while the three engineers were conforming to the Secretary of War their technical pledges and sealing its re-embodiments, with a roar it went crashing down into the reservoir. Two authoritative technical journals have published accounts of the failure; both were of contributions in text, photographs and data from the sources directly interested in minimizing the extent of the occurrence. The two descriptions are accurate as far as they go, but they are naturally more conspicuous for the sagacity with which they leave things unsaid, than for their illuminating comprehensiveness. The import and the relationships of the sinister happening are therefore, of course, quite pardonably ignored. It is considered from a local standpoint alone, and no mention is made of its having any bearing upon anything but academic questions of earth dams.

The slide in this dike is however unfortunately, not an isolated misadventure to be casually reviewed, while broken personal prestige rehabilitates itself by virtue of charity and silence. It is a national concern and should be studied as such for it is related directly and intimatedly to the expenditure of half a billion dollars. The Wachusett dike carried the destinies of the Government's Panama Canal. The great Gatun dam, the central feature of the Isthmian Waterway, was designed upon much more adverse foundations, by the self-same engineer, from the self-same model, as was the north dike of the Clinton reservoir, and the engineering reliableness and actual structure are together there weighed in the balance and found ominously wanting.

Earth dams are as old as Mother Earth herself. They have been built successfully and rightly in every quarter of the globe as long as man has been man, so the naive conclusion that the "dike type of earth dam is not discredited" will probably go undisputed. But Nature has certainly repudiated violently this individual design of the earth dam and the quality of discernment, judgment and experience which evolved it.

An inspection of Fig. 1 in the illustration shows that the portions A, B, S, C and R are the essential artificial elements. The office of A is the vital one of protecting and supporting the impervious core B, and of carrying the shield of rip-rap against erosion.



Cross Section of Wachusett Dam

(A—Ridge of triangular section with front slope of 2 to 1 and rear slope of 1 to 1. B—Packed or rolled clayey earth, 6 in. layers. C—Mass of earth to minimize rate of percolation through and under dam. E—Natural ground. G—Gravel layer and berm. R—Rip-rap, 10 ft. thick. S—Sheet Piling.

Since the earth core, B, lies on the steep rear slope of A, the upper part B′ naturally owes its position and integrity almost entirely to A. It is evident that the stability and integrity of A are a sine qua non of the dam. The material of A is derived from the natural earth, E, and is the same in character except that E is consolidated by rain and eons of time, while A is a recent artificial ridge. The material is a fine, silt-like sand, water and glacier-ground until its dominant particles have had the angularities rounded. It is, when dry, decently reliable in a bank or cut, but when wet it takes on channel characteristics, just as do the Panama soils. These changes must be anticipated and forestalled. Both develop a treacherous, unstable, mushy, pasty disposition. Both flow and flatten out, the particles sliding over one another, somewhat similar to their action in quicksand The Panama soil becomes in addition viscous and pasty. So long as there was no water in the Clinton reservoir, the ridge A stood all right, but as the water rose the lower planes of the mass were successively saturated, the voids filling directly and by capillary action. The upper portions were dampened by the melting snows and spring rains. Finally the critical stage and state were reached, friction was overcome through saturation, and somewhere below water level in the lower part of A or in the bottom E a displacement occurred and the upper portion A′ subsided and slid away, carrying the gravel berm and the rip-rap with a rush into the lake. The full length of the section of the dam against which any water stood, and half the crest width, went. The upper outer corner of the core B broke off and subsided nearly vertically.

By the favor of chance the reservoir lacked 23 ft. of being full. Had it been full the entire mass A would have been thoroughly saturated and therefore in a critical condition, and the core B likewise saturated must have brought some additional weight, making still more for its deformation and displacement in the soggy ridge A. The point at the upper end of the slope line is very close to the ultimate reservoir height, and with a full lake or a few degrees flatter slope to the sodden slide, the dreadful would have happened. Against this danger the mass C afforded no protection whatever, since it would have been overtopped and eroded. Figs. 2, 3 and 4 show the cross sections of the Wachusett earth-dam imposed upon those of the Gatun, Sosa-Corozal and La Boca dams as now designed. They very graphically show what a very narrow margin corresponding slips to the same slope would leave in the Isthmian structures before they went in water avalanches to the seas.

In the report of the American Society of Civil Engineers, 1907, will be found a valuable paper on earth dams, in which the proposed Gatun construction for Panama and some of the pregnant features are lucidly treated. The designer of the Clinton Works contributed to the discussion: "The north dike of the Wachusett reservoir, and the proposed Gatun dam with their vast dimensions seem especially to have disturbed Mr. ——— as he speaks of the Gatun dam as a "monster dam design," "The writer as the designer of one of these dams and a participant in the design of the other, etc." This personal avowal of creatorship is quoted because with creatorship goes responsibility.

In two instances of gross mistakes in the Panama plans, the errors were saddled on to subordinates. Here the authorship of the Wachusett design is formally recorded by the engineer himself.

The Gatun dam for the Panama Canal was proposed by the five minority members of the International Board. Of the five, two only were supposedly dam specialists, the designer of the Wachusett dike and one of the designers of the old Bohio dam. The latter had been the undoing of the former 85-ft. project of 1901. It had been proven impracticable when competent investigation was made and had been completely abandoned. The leadership for the Panama dam problems was accorded therefore to the Wachusett specialist. He projected for Panama on both the Atlantic and Pacific sides a series of high earth dams, the Gatun, "the greatest construction ever undertaken by man." They were brought by their mass and by the fact of alluvial foundations into the realm of experiment utterly, but they were accepted by the four remaining experts, by the Commissioners and the Secretary of War, all because the north dike of the Wachusett reservoir was deemed such a convincing and shining example in new and advanced technique.

Its designer explained his art to the Senate Committee: "In some of the testimony it has been stated that this whole matter was an engineering guess. I wish to say distinctly that this is not, in my opinion, an engineering guess. There has been allowed a factor of safety that is beyond all factors allowed in the past."

Senator Morgan.—"Beyond all precedent?"

Mr. Stearns.—"Beyond all precedent, except in the case of this dam which I built, which is the precedent for this particular construction."

The five experts supporting the Isthmian proposition wrote: "The nearest precedent, in general design, for the Gatun dam is the north dike of the Wachusett reservoir, which at its deepest place will have 65 ft. against it." "The highest portion of this dike was built on exactly the plan proposed for the Gatun dam."

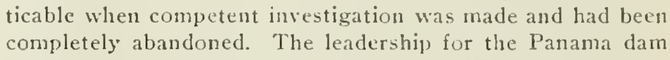


Fig. 2.—Gatun and Wachusett Dams.

The same steep earth-sustained 2 to 1 slope fronts the Gatun lake, 110 or more square miles in area, deluged in their season by tropic rain and lashed by the hurricane Isthmian winds into hungry, eating waves, as fronts the diminutive metropolitan reservoir, whose riplets, the local account says, were by good grace not blown toward the open wound of the earth core. The faces of both are protected by the same means—a layer of rip-rap, set on the slope of earth. As the mud of the marshes and the silt-jelly of Limon bay are to go into the body and heart of the Gatun dam, a sliding cushion for whatever is imposed upon them, so at Wachusett, the material of the dike under even partial saturation has become mud-jelly, which has slid with its rock facing to destruction. The notorious and never-failing characteristic of the saturation of Isthmian earth, is that it forms a pasty, sodden, yielding, swallowing mass, whose angle of repose is very flat—6 and more to 1. Witness the long, ever-moving, half mile, red, historic slide, and the other lesser slips at the Culebra; the boggy spoil areas; the mired steam shovels, and the glacier-creeping dumps near Pedro Miguel. So, we are to have for our world canal, the duplicate embodiment of a fetish formula, enough for homogeneous foundations which nature does not supply and requiring modification accordingly, applied equally to structures to meet any head, no matter how high, with no saving appreciation of such controlling factors as a deep lake, against nearly 7,000 ft. of front, five times the northern rainfall saturation, or the quiverings due to whirling rushes through lock sluices, and the vibrations of a spillway so planned that in a toboggan fall of 70 ft. it converges the flood escape from Gatun Lake, 700 ft. wide and 16 ft. deep into a concrete canyon but 150 ft. wide.

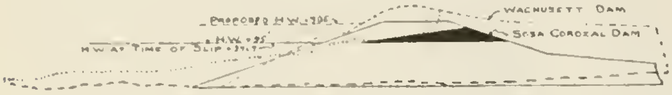


Fig. 3.—Soza-Corozal and Wacnusett Dams.

Estimating proportionately to weight, volume and length of the exposed embankment, which serves the function of a dam, together with the head of water, which each must withstand, one is brought to contemplate the serious and alarming likelihood, if not certainty, that an accident at the Isthmus commensurate with that of April 11th at the Boston reservoir, would have ended the career of the Panama Canal. Taking the Massachusetts slide length as 675 ft. and the volume at 100,000 cu. yds., and noting that the total length of the Gatun dam having water against it is over 10 times as great, that the exposed slope is over twice as long, and the crest 55 ft. higher, it becomes apparent from simple mathematics that the equivalent mass at Panama would be over 20 times the amount. Besides these there is the factor of saturation from twice the head of water, and five times the annual rainfall on still more treacherous material. From the first two elements alone two or more million cu. yds. would be the relative equivalence. Two or more million cu. yds. from the Gatun dam of silt-jelly from Limon bay or mud of the swamps, or sliding clays or pasty ashes of Culebra, going down with a crash into Gatun lake, and leaving the overtopped mass of the earth-fill at the scour of its waters, would mean a mortal disaster for the waterway. It will be presently seen that the foundation safeguards which were incorporated in the Wachusett dike were not, according to the latest official testimony, to be embodied in the Isthmian dam, so that its hazards from this further source are enormously increased. The repair of the very high dams at Panama will be particularly difficult. The Culebrat cut will be finished; its material will have been transported and deposited into embankments, and before more could be supplied, steam shovels and their train system must be installed de novo. The lake depth, 85 ft., is too great to admit of repair by the quick and effective methods of hydraulic dredges. Yet every minute and second after an accident, would be momentous, and the Gatun dam, if the slope rearward was overtopped, would soon be in the Atlantic Ocean.

The vital and inescapable dangers prepared for the country in this "monster Gatun design" was clearly set forth and impressed with all the force that the English language allowed, by the Majority of the Consulting Engineers, but the public has been mostly unacquainted with their message. This formidable slide of the Wachusett earth dam comes to confirm their prophesies.

With the Metropolitan dike, and the accident which sent one-seventh of its critical volume to the bottom of the reservoir, we concern ourselver only as it is the pattern, the model and precursor of its great progeny, the Isthmian dams.

Before the Investigating Committee of the Senate, the designer of all these structures detailed the series of laboratory tests with earths from which he demonstrated the different permeabilities, resistances, capillary actions, etc., in materials. Part were made at Lawrence, part at Clinton, Mass. They were conducted with a "galvanized iron tank filled with the sand or other material to be tested, the water being applied at the top and being drawn out at the bottom through a faucet. By opening or closing the faucet, different quantities of water could be made to pass and the difference in amounts of resistance caused by passing through 3 ft. was measured." "Another set of tests made made in a tank, a long wooden box 60 ft. long, 6 ft. wide and 8 ft. high." "The next test was in an iron pipe about 10 ins. in diameter and I think about 10 ft. long." "I built an experimental dike in this large, wooden tank that I spoke of. I am trying to show that this is not an engineering guess." From the laboratory tests the permeability, filtrations, resistences, etc., were figured out and the dike was built accordingly.

Some interesting tests were evidently conducted for Panama, also. "I had particularly requested in my communication to the Isthmus, sent through the proper parties, of course, that they take a sample of the material pumped up from the boring hole in a pail without letting any spill from the pail. This sample was taken as I requested and what we saw in the bottom of the pail was sand and fine material mixed with it so that one would say it was practically impervious, and then the last thing that settled in the pail was the fine clay which left a shiny surface over the whole thing, about as you see in the bottom of a mud puddle in the street after a rain, and that makes the bottom of the puddle pretty nearly water-tight. It showed very clearly as a single sample that there was this fine clay in sufficient quantities to make it substantially, if not absolutely watertight."

A pail of water to determine the probability of the greatest dam ever projected! This is the engineer who testified as to the means of propelling battleships and merchant vessels through the locks:

Senator Kittridge.—"How would you push the ship ahead? Would you use a windlass, or what?"

Mr. Stearns.—"Generally it would be by a tug behind it."

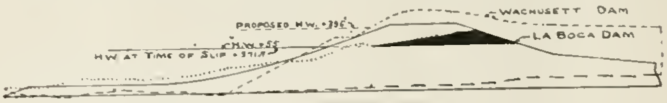


Fig. 4.—La Boca and Wachusett Dams.

A pushing tug, a pail of muddy water, a Bohio dam, a Wachusett dike—precious pledges for Gatun and the Panama Canal!

Senator Morgan.—"It has been stated in the testimony of the dams that failed * * * that this dam on the Mill river failed at a time when the water was 4 ft. below the top and it failed by the sloughing or caving of the lower end of the dam."

Mr. Stearns.—"It was built in a way that engineers would not build now * * * this slid off. I think the water came through and saturated this material, and it would not stand at that steep angle."

The designer confirming his elements in the dike of the 60-ft. box, embodied them in the Wachusett embankment, and without waiting for time to sift and test them, duplicating them in each and every embankment projected to hold up the deep lakes on the Isthmus. The integrity of the Gatun dam with over 30,000,000 tons of earth, holding up Lake Gatun at 85 ft. and of the Corozal and La Boca dams with 18,000,000 tons to create and sustain Lake Sosa at 65 ft. above low tide, has been assured to the nation upon the authority of the designer and design of the archetypal Clinton structure of great claims and sorry discomfiture.

The design was repeated in colossal forms, once at Gatun and thrice near Panama. Each and every one is a Wachusett dike in magnificat.

Almost immediately after the assembling of the "Board of Consulting Engineers" before there had been any time or opportunity to digest the Isthmian data or examine the physical factors and conditions, the author of this construction, a member of the Board, began the paean and the propaganda to duplicate the Wachusett performance on a grand scale, and make it the central and glorified feature of the Panama Canal. The collective body at his invitation, went down to Boston to study this last achievement in engineering. When, however, the Isthmian structure and its allied feature, the lock flights, were proposed they arrayed the two parties of the Board in opposition, which divided them fundamentally. The dam to weigh over 30,000,000 tons was to be the hughest structure ever attempted in history. It was, therefore, in that fact alone an experiment with no precedent of guarantee in time or place. The Majority therefore set itself squarely upon the first tenet—the Panama Canal should not be an experiment in canal building. "The Board is unqualifiedly of the opinion that no such vast and doubtful experiment should be indulged in, but, on the contrary, that every work of whatever nature should be so designed and built as to include only those features which experience has demonstrated to be positively safe and efficient."

Having thus condemned the principle of adventure and speculation in the great national work, they proceeded to point out the chances against the success of this particular experiment. The foundations at Panama were not of rock but of acknowledged alluvium. In the Gatun gorges there was a surface stratum of clay in places but 31 ft. thick. Underneath this extending from 31 ft. down to 203 and 258 ft. the material was pervious, watersoaked and artesian, the discharge rising in the driven tubes from 7 to 18 ft. above the river. Not alone was it gambling, it was foolhardy to trust the mass of 21,000,000 cu. yds. upon such foundations. The Majority wrote: "The subsurface material at Gatun extending down to the hard indurated sandy clay or soft rock attaining a maximum depth of 258 ft., is in large part, of a comparatively fine character, consisting of sand and clay in various degrees of mixture, but the boxings have also shown coarse sand and gravel, with water flowing through it and out of some of the pipes used in making the examination." And again, "These are disquieting considerations in the designs of dams to retain water of depths varying from 30 to possibly 85 ft. or more." "The United States Government is proposing to spend many millions of dollars for the construction of this great waterway, which is to serve the commerce of the world for all time, and the very existence of which would depend upon the permanent stability and unquestioned safety of its dams. The Board is therefore of opinion that the existence of such costly facilities for the world's commerce should not depend upon great reservoirs held by earth embankments, resting literally upon mud foundations or those of even sand and gravel." "There are grave reasons for doubting the stability of these types of structures under such circumstances."

Finding the design prepared for the waterway by their Minority Colleagues thus freighted with mischief, they detailed a lock canal plan which they pronounced free from the menacing features and which was recorded as being safe and untainted of the experimental. This design had its summit level not at 85 but at 60 ft. It incorporated a third lake, thus abolishing locks in flight and high dams. The best arrangement enabled the vast Gatun embankment to be superseded by one of a quarter the volume under a 29-ft. head. The head being reduced to less than a third eliminated the technical problems. "This plan provides for a summit level of moderate height and for corresponding dams. It would have duplicate locks throughout of one lift only between adjacent levels. (Not flights.)"

It is apparent, therefore, that a lock canal at Panama did not at all necessarily involve the abnormal, the perilous or the questionable. The Majority being thus uncompromisingly against the central and pivotal elements of the high level scheme, the five engineers arranged to buttress their dam by the same measures of foundation—safeguarding that they had incorporated at Wachusett. "In that case (the Boston reservoir) deep and heavy sheet piling or deep excavation of the natural soil with refilling of suitable material was employed to prevent seepage or percolation, wherever it was apprehended that the nature of the sub-strata was such as to permit it." "It is the judgment of the Board that such safeguarding features as core walls, sheet piling or the removal of unsuitable material should not be omitted in similar structures on this work of extraordinary magnitude and supreme importance." The Minority five then conceded this. They wrote: "In the construction of the dam it is proposed to excavate surface material to such an extent that the impervious material of the embankment will come in direct contact with the impervious clayey material; also to do any other work required to cut off the flow through any pervious material, which further investigations may disclose." They added an allowance to be included in the estimate of cost of the dams of $400,000. The Gatun dam became, therefore, safeguarded in the exact way as the Wachusett dike, so it was supposedly vouched for and guaranteed in the success of its small predecessor.

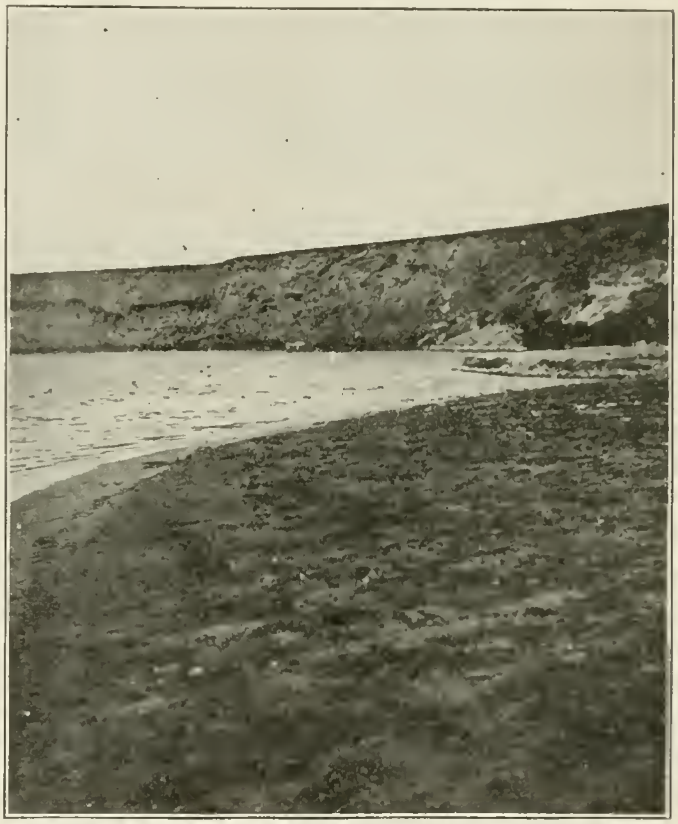


Fig. 5.—South Half of Slide at the North Side of the Wachusett Reservoir.

Soon, however, the five engineers were brought up to the practical question of "How, how?" Then the Panama proposition went off into the air and the Gatun dam fell summarily out of even the Wachusett class. The pervious strata in the two gorges at Gatun extend to 204 and 258 ft., much below the limits of caisson or sheet piling work. Their width at sea level is roundly 2,700 ft. It became speedily patent that these experts had proposed and stipulated the physically impossible, since cutting off the water in the deep gorges was the dream of engineering Quixotes. Before the Senate Committee, therefore, they openly and entirely abandoned the provision thus categorically specified. The Isthmian structure of 30,000,000 tons in weight under an 85-ft. head was there acknowledged to be then projected and advocated without the defenses and precautions which had been incorporated to safeguard the small Wachusett dike with but 65 ft. of head against some 675 ft. alone of its length. Notwithstanding this, they argued speciously and persistently that the Gatun dam would be quite safe. Why not? They had tested sands and gravel carefully in two laboratories, in tanks and tubes with three feet of material, a faucet and a miniature dike in a box. They had settled the slope, the permeability and all other factors of safety, as the designer averred, "beyond all precedent, except in the case of this dam which I built."

The lock flights complementary to the pernicious high dams were pronounced by the Majority of the Board of Consulting Engineers even more dangerous and objectionable than the dams. It was recorded that there were "perilously near impracticable for battleships" and extra hazardous for large merchants ships. But the Triumvirs have just reported that the rock ("argillaceous sandstone" is its latest name) will withstand the concrete lock weights. It has all been tested and proven in another box of sand. They write: "Additional tests were made at our request with an improvised apparatus to give a further indication of the ultimate supporting power of the rock. In making these tests irregular pieces of the rock about 3 ins. to 10 ins. across were bedded in sand in a box resting on scales so that the top of the pieces would be substantially sure."

All this testing of weights as settling the question of lock foundations is quite beside the mark. No one has disputed that the sandstone where it exists is a good and adequate foundation for a lock. But what of the foundations where it does not exist, and the masonry must repose upon the pervious strata? These are the conditions which are impeached. There is no mention of this feature in the "deciding report." The objections to the lock tiers are not answered or touched by testing the crushing limit of indurated clay. The relation of the lock tiers to navigation, the locating of the lower lock and approaches in a morass, the setting of the upper lock to overhang this "argillaceous sandstone," the absence of foundations for the upper approaches, the impracticability of establishing proper safety dams to safeguard the summit lake, the inadequate width of the locks to anticipate battleship growth, questions of future lake saturation in the pervious strata under the locks, all these and many allied problems are avoided. The avoidance is well. Bohio and Wachusett consort illy with Delphic oracles. Pronouncements are purposed upon the Gatun dam. The country knows just what these will be. The corroboration of their former decision will be complete and unanimous, and it will be announced anew to the country that the Panama dams are safe and certain—like the north dike of the Wachusett reservoir.

Mr. H. A. Horning, heretofore Division Foreman of Buildings of the Michigan Central R. R., with headquarters at Niles, Mich., has been appointed Assistant Superintendent of Buildings, with headquarters at Jackson, Mich. He succeeds Mr. F. M. Hill, who has left the service of the Michigan Central to become Engineer for the Reinforced Concrete Pipe Co., of Jackson, Mich.

Catalogs Worth Having.

No. 0279. **Sarco Asphalt.** The Standard Asphalt & Rubber Co., Chicago, Ill.

This catalog describes the character and manufacture of Sarco Asphalt as distinguished from the natural asphalts, such as those from Trinidad Lake. It is stated that Sarco paving asphalt contains 100% bitumen—no earthy matter, no organic matter and no salts. As a paving and roofing material, the claim is made that it is ductile and pliable at freezing temperature and has a melting point far above the hottest summer temperature. The company issuing the catalog is fully equipped for turning it out in large quantities for street work and also for roofing, waterproofing and other similar uses. The catalog is well worth securing for its description of an interesting material.

No. 0280. **Concrete Mixers.** The Cockburn Barrow & Machine Co., Jersey City, N. J.

This catalog describes briefly the Judd-Cubical Concrete Mixer. The cube is operated by means of a pinion meshing with a circumferential rack. One of its special features is the arrangement by which the batch is discharged. Three discharge scoops are so placed within the cube that when the cube is being rotated in the direction for mixing concrete the scoops are inoperative but when the cube is rotated in the reverse direction the scoops collect the mixed concrete and discharge it. The machine is an interesting one and is well described in this pamphlet.

No. 0281. **Tubular Well Supplies.** Cook Well Co., St. Louis, Mo.

This is a catalog and price list of a large line of tubular well supplies manufactured by the well known company named above. The apparatus illustrated in the catalog contains about everything that is necessary for driving and equipping tubular wells for city and other water supplies. The catalog is handsomely gotten up in leather binding and will prove useful to any city engineer.

No. 0282. **Electric Machinery for Cement Plants.** The Westinghouse Companies, Pittsburg, Pa.

In constructing the new works of the Bath Portland Cement Co., at Bath, Pa., all machinery was designed to be operated by electric power. This pamphlet, which has been issued by the Westinghouse Companies, describes and illustrates in considerable detail the electric power plant furnished to do the work. The pamphlet presents a good argument for the advantages of electricity for operating similar plants.

No. 0283. **Compressol System of Foundation Construction.** Hennebique Construction Co., New York, N. Y.

In this catalog the company named describes a new system of concrete foundation and construction. This method has been used in France for some years and has been described at various times in the French technical papers. This is, however, the first time that an attempt has been made to introduce it in the United States. An arrangement like a pile driver, which carries, in place of a hammer, a heavy iron cone, is used to form holes in the ground. The cone is repeatedly dropped like a pile driver hammer until the ground has been penetrated the proper depth. Concrete is then placed in the hole and a blunt-pointed hammer is used to compress it. The result is the formation of a concrete pillar or pile. Many claims are made by the inventors for the advantage of this type of pile construction over that commonly employed where the pile is molded in forms and then driven in the usual manner. Engineers who have not been made familiar with this type of construction by reading foreign papers will find this catalog of decided interest.

Mr. Charles Derleth, Jr., has severed his connection with the American Builders' Review, a monthly journal published in San Francisco, devoted to Architecture and Engineering, of which he has acted as editor during the past nine months.

CONTRACT NEWS

We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Bids Open.		See Issue.
July 17.	Sandusky, O.	July 3
July 18.	Wilkesbarre, Pa	July 17
July 18.	Burrillville, R. I	July 17
July 19.	Terre Haute, Ind	July 17
July 19.	Fort Snelling, Minn	June 19
July 19.	Ottawa, Ill.	July 10
July 19.	Cincinnati, O.	July 10
July 20.	Culpeper, Va.	June 26
July 20.	San Juan, Porto Rico	June 12
July 20.	Grand Rapids, Mich	July 17
July 22.	Chilhowie, Va	July 17
July 22.	Oakland, Cal	July 17
July 22.	San Jose, Cal	July 17
July 23.	Columbia City, Ind.	July 3
July 26.	Elkhart, Ind	July 17
July 27.	Cleveland, O.	July 3
July 27.	Elberton, Ga.	July 10
July 29.	Chardon, O.	July 3
July 29.	Tiffin, O	July 17
July 29.	Wichita, Kan	July 17
July 30.	Hamilton, O	July 17
July 31.	Hattiesburg, Miss.	July 10
Aug. 1.	East St. Louis Ill	July 17
Aug. 1.	Woodland, Cal	July 17
Aug. 3.	Cleveland, O.	July 10
Aug. 5.	Jackson, O.	July 10
Aug. 5.	Rome, Ga	July 17
Aug. 5.	New Bern, N. C	July 17
Aug. 6.	Covington, Ind	July 17
Aug. 10.	Cleveland, O	July 17
Sept. 30.	Santiago, Chile	July 17

Buildings

Bids Open.		See Issue.
July 17.	Fort Benjamin Harrison, Ind.	July 10
July 17.	St. Joseph, Mo	June 26
July 18.	Washington, D. C.	June 26
July 18.	Chattanooga, Tenn	June 26
July 18.	Williamsport, Ind.	June 12
July 18.	Baxley, Ga.	July 3
July 18.	Wilkesbarre, Pa.	July 3
July 18.	Wapakoneta, O.	July 3
July 18.	Neah Bay, Wash.	July 3
July 18.	New York, N. Y	July 17
July 19.	Kellogg, Ia	July 17
July 19.	Buffalo, N. Y	July 10
July 19.	Gainesville, Fla.	June 19
July 19.	Gainesville, Fla.	June 26
July 19.	Athens, O.	June 25
July 19.	Fort Leavenworth, Kan.	July 3
July 20.	Minneapolis, Minn.	July 3
July 20.	Fresno, Cal.	July 3
July 20.	Jacksonville, Fla.	July 3
July 20.	Pickens, S. C	July 10
July 20.	Franklin, Ind.	July 10
July 20.	Newberry, Ind.	July 10
July 20.	Cassville, Mo	July 17
July 20.	New Lexington, O	July 17
July 20.	Flint, Mich	July 17
July 20.	Newberry, Ind	July 17
July 20.	Franklin, Ind	July 17
July 20.	Coatesville, Ind	July 17
July 22.	New York, N. Y	July 17
July 22.	New York, N. Y	July 17
July 22.	Brooklyn, N. Y	July 17
July 22.	Norway, Mich	July 17
July 22.	Everett, Wash	July 17
July 22.	New Orleans, La	July 17
July 22.	East Orange, N. J	July 3
July 22.	Casper, Wyo.	June 26
July 23.	Newport, R. I	July 17
July 23	Cheyenne, Wyo.	July 3
July 23.	Bishopville, Ga.	July 10
July 23.	Cortlandt, N. Y	July 10
July 23.	Cleveland, O	July 17
July 23.	Hurdsfield, N. Dak	July 17
July 24.	Lincoln, R. I	July 17
July 24.	Clarksburg, W. Va	July 17
July 24.	Hoboken, N. J	July 10
July 24.	Fort Sam Houston, Tex	July 3
July 24.	Aurora, Ill.	June 26
July 25.	Marion, Ind.	July 10
July 25.	New York, N. Y	July 17
July 25.	Newark, N. J	July 17
July 25.	New Roads, La	July 17
July 25.	Marietta, O	July 17
July 26.	Chicago, Ill	July 17
July 27.	Potosi, Mo.	July 10
July 29.	Yuma, Ariz.	July 10
July 29.	Jackson, Mich	July 17
July 30.	Ames, Ia	July 17
July 31.	Owosso, Mich	July 17
July 31.	Washington, D. C	July 17
July 31.	Owosso, Mich.	July 3
Aug. 1.	Washington, D. C	July 10
Aug. 1.	Bowling Green, Va	July 17
Aug. 4.	Hannaford, N. Dak	July 17
Aug. 5.	Tallahassee, Fla	July 17
Aug. 5.	Cleveland, O	July 17
Aug. 5.	Crookston, Minn.	July 3
Aug. 6.	Columbus, O.	July 10
Aug. 6.	Brooklyn, N. Y	July 17
Aug. 6.	Asheville, N. C	July 17
Aug. 6.	Wabash, Ind	July 17
Aug. 7.	Halifax, N. S	July 17
Aug. 9.	Lakewood, O	July 17
Aug. 9.	Monticello, Ind.	July 3
Aug. 12.	Mason City, Ia	July 3
Aug. 15.	Bakersville, N. C	July 17
Aug. 19.	Alexandria, Minn	July 17
Aug. 20.	Decatur, Ill	July 17
Aug. 22.	Jackson, Mich	July 17
Aug. 24.	Geneva, Ill	July 17

Roads and Streets.

Bids Open.		See Issue.
July 17.	Brooklyn, N. Y	July 10
July 17.	Sewickley, Pa.	July 10
July 18.	Brookhaven, N. Y	July 10
July 18.	St. Paul, Minn	July 10
July 18.	Wilkesbarre, Pa	July 10
July 18.	Wellsville, O.	July 10
July 18.	Spencer, Ind.	July 10
July 18.	Milwaukee, Wis	July 17
July 18.	Hamilton, O	July 17
July 18.	Champaign, Ill	July 17
July 19.	New York, N. Y	July 17
July 19.	Dixon, Ill	July 17
July 19.	Danville, Ill	July 17
July 19.	Youngstown, O.	July 10
July 19.	Cincinnati, O.	July 3
July 19.	Columbus Barracks, O.	July 3
July 19.	Bluffton, Ind.	July 3
July 19.	Fort Leavenworth, Kan	July 3
July 20.	Oshkosh, Wis.	July 3
July 20.	Findlay, O.	July 3
July 20.	Greencastle, Ind.	June 26
July 20.	Crawfordsville, Ind.	June 25
July 20.	Findlay, O.	June 26
July 20.	Kangley, Ill	July 17
July 22.	Oswego, N. Y	July 17
July 22.	Kansas City, Mo	July 17
July 22.	New Orleans, La	July 17
July 22.	Steubenville, O	July 17
July 22.	Syracuse, N. Y	July 17
July 22.	Frankfort, Ind	July 17
July 22.	Oakland, Cal	July 17
July 23.	Chicago Ill	July 17
July 23.	Kansas City, Mo	July 17
July 23.	Huntington, Ind	July 17
July 23.	Painesville, O.	July 3
July 23.	Mount Gilead, O	July 10
July 25.	Jersey City, N. J	July 17
July 25.	New York, N. Y	July 17
July 25.	El Reno, Okla	July 17
July 26.	Tipton, Ind	July 17
July 26.	Appleton, Wis	July 17
July 26.	Cincinnati, O.	July 10
July 27.	Greencastle, Ind	July 17
July 27.	Olympia, Wash	July 17
July 27.	Cleveland, O.	July 3
July 29.	Shawano, Wis	July 17
July 30.	Newark, N. J	July 17
July 30.	Ashland, Ore	July 17
July 30.	Steubenville, O	July 17
July 30.	Des Moines, Ia	July 17
July 30.	Jefferson, O.	July 10
July 30.	DesMoines, Ia.	July 10
July 30.	Hagerstown, Md.	July 10
July 31.	Kansas City, Mo	July 10
July 31.	Fort Greble, R. I	July 17
Aug. 1	Rahway, N. J	July 17
Aug. 1.	Greencastle, Ind	July 17
Aug. 1.	Greencastle, Ind.	July 3
Aug. 2.	Cincinnati, O.	July 10
Aug. 3.	St. Clairsville, O	July 17
Aug. 3.	New Bremen, O	July 17
Aug. 5.	Greensburg, Ind	July 17
Aug. 5.	Olympia, Wash	July 17
Aug. 5.	Sullivan, Ind	July 17
Aug. 5.	Boonville, Ind.	July 10
Aug. 6.	Sharpsville, Pa.	July 10

Sewers.

Bids Open.		See Issue.
July 17.	Iron River, Mich	July 10
July 18.	Wellsville, O.	July 10
July 18.	Newark, N. J	July 17
July 18.	Kansas City, Mo	July 17
July 18.	Ames, Iowa	July 17
July 19.	Waukegan, Ill	July 17
July 19.	Youngstown, O.	July 10
July 19.	Spencer, La.	July 10
July 20.	Oshkosh, Wis.	July 10
July 20.	Pensacola, Fla.	June 26
July 22.	Willoughby, O.	June 19
July 22.	San Jose, Cal	July 3
July 22.	Philadelphia, Pa.	July 10
July 22.	Cordele, Ga	July 10
July 22.	Crawfordsville, Ind	July 17
July 23.	Chicago, Ill	July 17
July 23.	Kansas City, Mo	July 17
July 24.	Brooklyn, N. Y	July 17
July 24.	Cleveland, O	July 17
July 24.	Oakland, Cal.	July 10
July 24.	Aberdeen, Wash.	July 10
July 24.	Henderson, N. C	July 10
July 25.	Janesville, Wis.	July 10
July 25.	Frankfort, Ind.	June 19
July 25.	Frankfort, Ind.	June 26
July 26.	Buffalo, N. Y	July 17
July 27.	Evansville, Ind	July 17
July 30.	Des Moines, Ia	July 17
July 22.	Council Bluffs, Ia	July 17
July 29.	Pekin, Ill	July 17
July 19.	Troy, N. Y	July 17
July 29.	New Castle, Pa	July 17
July 30.	DesMoines, Ia.	July 10
Aug. 3.	New Bremen, O	July 17
Aug. 5.	Grand Forks, N. Dak	July 17
Aug. 5.	Plainfield, N. J	July 17
Aug. 5.	North Milwaukee, Wis	July 17
Aug. 6.	Alexandria, La.	July [illegible]
Aug. 8.	Bloomfield, Ind	July 17
Sept. 11.	New Orleans, La	July [illegible]

Water Supply.

Bids Open.		See Issue.
July 18.	Hamilton, O	July 17
July 20.	St. Paul, Minn.	July 3
July 20.	Chesterton, Ind	July 17
July 22.	New York, N. Y	July 17
July 22.	Randolph, Neb	July 17
July 22.	Omaha, Neb.	July 3
July 22.	Burlington, Vt.	July 10
July 23.	Irvington, N. Y	July 17
July 25.	Bradentown, Fla	July 17
July 25.	Cissna Park, Ill	July 17
July 26.	Decatur, Ill.	July 10
July 29.	West Point, N. Y	July 17
July 31.	North Battleford, Sask.	July 3
Aug. 1.	Jamestown, N. Y	July 17
Aug. 5.	Decorah, Ia	July 17
Aug. 5.	Fort Adams, R. I	July 17
Aug. 6.	Cherokee, Ia	July 17
Aug. 7.	Steelton, Pa	July 17
Aug. 8.	Fort Oglethorpe, Ga	July 17
Aug. 9.	Fort Hancock, N. J	July 17
Aug. 13.	Columbus, O	July 17
Aug. 19.	Sacramento, Cal.	June 5
Sept. 4.	New Orleans, La.	July 3

Miscellaneous.

July 17. Fort Myer, Va., Garbage Crematory, June 26
July 18. Brooklyn, N. Y., Riprap Sea Wall, July 3
July 18. Albany, N. Y., Aqueduct, June 26
July 18. Cincinnati, O., Concrete Dam, June 26
July 18. Buffalo, N. Y., Foundation Work, July 10
July 18. Boston, Mass., Subway Entrance, July 10
July 18. Washington, D. C., Concrete Conduit, July 10
July 19. San Francisco, Cal. Wharf Repairs, July 17
July 20. Chicago, Ill. Conduit System, July 17
July 22. Fort D. A. Russell, Wyo., Garbage Crematory, July 3
July 22. Oyster Bay, N. Y. Sea Wall, July 17
July 23. New York, N. Y. Removing Columns, July 17
July 23. New York, N. Y. Trolley Approaches, July 17
July 23. New York, N. Y. Test Borings, July 17
July 23. Chicago, Ill. Screens and Galleries, July 17
July 23. Fort Morgan, Ala., Wharf Repairs, Etc., July 3
July 24. Chicago, Ill. High Pressure Piping, July 17
July 24. Baltimore, Md. Refuse Removal, July 17
July 26. Toledo, O. Power Plant, July 17
July 26. New York, N. Y. Freight Sheds, July 17
July 26. Holland, Mich., Pier Repairs, July 3
June 26. Winnetka, Ill., Pile Pier, June 26
July 27. Boston, Mass., Concrete Floor, July 3
July 29. Milford Haven, Va., Riprap Jetties, July 10
July 30. Fort Monroe, Va., Track Work, July 10
July 30. New York, N. Y., Retaining Wall, July 3
July 31. Tacoma, Wash. Power Plant, July 17
Aug. 1. Washington, D. C., Torpedo Boats, June 5
Aug. 2. Racine, Wis., Breakwaters, July 10
Aug. 3. Jackson Barracks, La. Wharf Repairs, July 17
Aug. 3. San Juan, R. I., Pier Repairs, June 26
Aug. 5. Harrisburg, Pa., Garbage Disposal, June 26
Aug. 6. Cleveland Heights, O., Street Lighting, July 10
Aug. 6. New York, N. Y., Dams, July 10
Aug. 12. Brownsville, Pa. Lock, Walls, Etc., July 17
Aug. 20. San Diego, Cal., Wharf and Trestle, June 26
Sept. 3. Winnipeg, Man., Hydro-Electric Development, June 19

Excavation, Earth and Rock.

July 17. Baltimore, Md., Dredging, July 10
July 17. New York, N. Y., Dredging, June 19
July 17. Newport, R. I., Dredging, June 19
July 17. Block Island, R. I., Dredging, June 26
July 18. Grand Rapids, Mich., Rock Excavation, Etc., July 3
July 20. Charleston, S. C., Dredging, June 26
July 20. Portsmouth, N. H., Ledge Removal, June 26
July 20. Charleston, S. C., Dredging, July 3
July 22. Lebanon, Ind. Ditch Work July 17
July 22. New York, N. Y. Athletic Field, July 17
July 23. Chicago, Ill. Dredging, July 17
July 24. Jacksonville, Fla., Dredging, June 26
Aug. 24. New York, N. Y., Dredging, July 3
July 24. New York, N. Y., Dredging, July 3
July 24. Carroll, Ia., Ditch Work, July 3
July 27. Woodbridge, N. J., Dredging, July 3
July 29. Skagway, Alaska, Dredging, Etc., June 19
July 30. Newark, N. J., Dredging, July 3
July 31. Albany, N. Y., Barge Canal Work, July 10
July 31. Galveston, Tex., Dredging, July 10
Aug. 1. Marshalltown, Ia., Drainage Ditch, July 10
Aug. 1. Emmetsburg, Ia., Drainage Work, July 3
Aug. 1. Nevada, Ia., Ditch Work, July 3
Aug. 1. Milner, Idaho. Irrigation Canal, July 17
Aug. 2. Nevada, Ia. Ditch Work, July 17
Aug. 5. Greenfield, Ind. Ditch Work, July 17
Aug. 6. Newton, Ia. Ditch Work, July 17
Aug. 6. Pocahontas, Ia. Drainage Work, July 17
Aug. 7. San Juan, P. R., Dredging, July 3
Aug. 12 Norwalk, Conn. Dredging, July 17

Materials, Machines, Supplies, Tools Etc

July 17. Fort Benjamin Harrison, Ind. Troughs, Etc., July 10
July 18. Commerce, Tex., Waterworks Equipment, July 10
July 18. Cleveland, O., Garbage Cars, July 10
July 18. Wilkesbarre, Pa., Vitrified Paving Blocks, July 10
July 19. Buffalo, N. Y. Hose, Cable, Fire Engines, Etc., July 17
July 19. Chicago, Ill. Boilers, July 17
July 20. Washington, D. C., Wire, July 10
July 20. Puget Sound, Wash., Traveling Cranes, June 26
July 22. Washington, D. C., Chain, Wire Rope, Etc., July 10
July 23. Hoboken, N. J., Fire Engines, July 3
July 23. Mare Island, Cal., Cement, Pipe, Etc., July
July 23. Chicago, Ill. Corporation Ferrules, July 17
July 23. Chicago, Ill. Pump, Barrel, Etc., July 17
July 23. Norfolk, Va. Wire, Rope, Hose, Etc., July 17
July 23. Charleston, S. C. Motor Drive Outfits, July 17
July 23. New York, N. Y. Ice Machines, Pipe, Etc., July 17
July 23. Portsmouth, N. H. Milling Machine, July 17
July 23. Boston, Mass. Pulleys, Pipe, Drills, Etc., July 17
July 23. New Orleans, La. Steam Hammer, Blower, Etc., July 17
July 23. Washington, D. C. Valves, Tubing, Etc, July 17
July 24. New York, N. Y. Fire Alarm Supplies, July 17
July 25. Brooklyn, N. Y. Limestone, July 17
July 25. Brooklyn, N. Y. Top Soil, July 17
July 25. Omaha, Neb., Electric Elevator, July 3
July 30. Washington, D. C. Pipe, Pumps, Rope, Etc., July 17
July 30. San Francisco, Cal., Boilers, July 3
July 30. Fort Monroe, Va., Locomotive, Cars, July 10
July 30. Columbus, O., Engine, Dynamo, Etc., July 10
July 31. Washington, D. C. Steel Shelving, July 17
Aug. 10. Portsmouth, N. H. Elevator, July 17

BIDS ASKED.

Bridges.

Items Arranged Alphabetically by States.

Oakland, Cal.—Bids are asked by John P. Cook, Clerk Board of Supervisors of Alameda County, until July 22 for a new bridge to be built over the creek on the Redwood road.

San, Jose, Cal.—Bids are asked by Supervisors of Santa Clara County, until July 22, for the construction of a concrete bridge on Wildcat Creek at Allendale Ave. Henry A. Pfister, Clerk.

Woodland, Col.—Bids are asked by Clerks Yoloa and Solano Counties until 11 a. m., Aug. 1, for building a reinforced concrete bridge over Putah Creek, consisting of three 115-ft. spans. C. F. Hadsall, Clerk, Yolo County, Woodland.

Rome, Ga.—Bids are asked by Board of Commissioners of Floyd County until Aug. 5 for the furnishing and erecting complete a steel truss bridge of 60 ft. span over Silver Creek. J. F. Hillyer, Clerk.

East St. Louis, Ill.—Bids are asked by Board Local Improvements, until noon, Aug. 1, for rebuilding Broadway viaduct in this city. Plans, etc., at office of W. J. Crocken, City Engineer. The above work is advertised in Engineering-Contracting.

Covington, Ind.—Bids are asked by Commissioners of Fountain County until noon, Aug. 6, for contracting following bridges: Two 100-ft. spans, one 90-ft. span, one 70-ft. span, two 60-ft. spans, one 26-ft. span, one 18-ft. span, with concrete abutments; abutments to be let separate or with the bridge.

Elkhart, Ind.—Bids are asked by Commissioners of Elkhart County, until July 26, for the construction of a bridge across the St. Joseph River on the line between Cleveland and Concord Townships.

Terre Haute, Ind.—Bids are asked by Jerome W. Denehie, County Auditor, until 11 a. m., July 19, for construction of concrete bridge on Clinton Road, in Sugar Creek Township.

Wichita, Kan.—Bids are asked by County Commissioners, C. N. Cartwright, Clerk, until July 29, for labor and material for reinforced concrete bridge over Arkansas River at Douglas Ave.

Grand Rapids, Mich.—Bids are asked by County Commissioners until July 20 for construction of two bridges in Byron Township.

New Bern, N. C.—Bids are asked by County Commissioners until noon, Aug. 5, for the construction of a steel highway drawbridge over Swiff Creek at Vanceboro, and also over Brice's Creek near New Bern, both in Craven County. Plans, etc., at office of the Register of Deeds, New Bern, N. C., and with Matthew & O'Brien, Engineers, Wilmington, N. C.

Cleveland, O.—Bids are asked by County Commissioners, Julius C. Dorn, Clerk, until 11 a. m., Aug. 10, for the construction of bridge work per report No. 1612, concrete arch culvert, Parma Township, and report No. 1607, steel concrete bridge, Parma Township, in accordance with the form of contract and specifications to be furnished by A. B. Lea, County Surveyor, Court House, W. 3rd St., Cleveland.

Hamilton, O.—Bids are asked by Chr. Pabst, County Auditor, until 10 a. m., July 30, for labor and material for erection of a new superstructure of bridge over Nine Mile Creek at the Wilson B. Smith farm on the Seven Mile & Collinsville Pike. Certified check for $200 required with bid.

Tiffin, O.—Bids are asked by Auditor of Seneca County, until July 29, for labor and material necessary to repair and strengthen West Perry St. bridge over the Sandusky River in Tiffin.

Wilkesbarre, Pa.—Bids are asked by James N. Norris, County Controller, until 1 p. m., July 18, for repairing and reconstructing bridge over Mill Creek on Moch St. in Miner's Mills Borough.

Burrillville, R. I.—Bids will be received at office of Seagrave & Lincoln, Engineers, 35 Commercial Bldg., Woonsocket, R. I., until 6 p. m., July 18, for construction of stone arch bridge over Branch River at Nasonville.

Chilhowie, Va.—Bids are asked by W. G. Baylor, Secretary, until July 22, for a steel wagon and foot bridge to be constructed across the Holston River at Chilhowie, Va.

Santiago, Chile.—Bids are asked by the Ministry of Industries and Public Works, until 2 p. m., Sept. 30, for several bridges to be erected in Chile. Specifications may be examined at the Legation of Chile, Washington, D. C., and at Messrs. Wessel, Duval & Co.'s, 25 Broad St., New York.

Buildings.

Items Arranged Alphabetically by States.

Washington, D. C.—Bids are asked by Elliott Woods, Superintendent, U. S. Capitol Building and Grounds, Washington, D. C., until noon, July 31, for marble floors for stairhalls, staircases, wall bases, etc., House of Representative Office Building.

Tallahassee, Fla.—Bids are asked by N. P. Bryan, Chairman Board of Control, Jacksonville, Fla., until noon, Aug. 5, for erection of dormitory building for Florida Female College at Tallahassee. Edwards & Walter, Architects, Columbia, S. C.

Chicogo, Ill.—Bids are asked by Business Manager of the Board of Education, room 730 Tribune Bldg., until noon, July 26, for the following school work: Doolittle school, boiler room addition, etc., general contract; Thorp school, wire guards; Oglesby school, wire guards.

Decatur, Ill.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Aug. 20, for construction complete of U. S. Post Office at Decatur.

Geneva, Ill.—Bids are asked by Ernest P. Bicknell, President Trustees State Training School for Girls, until 2 p. m., Aug. 24, for the construction of four new cottages. W. Carbys Zimmerman, Architect, Suite 1101, Steinway Hall, Chicago, Ill.

Coatesville, Ind.—Bids are asked by Trustee of Floyd Township, Putnam County, Coatesville, until 11 a. m., July 20, for the construction of a 3-room frame school house.

Franklin, Ind.—Bids are asked by Advisory Board of White River Township, Johnson County at Franklin, until 2 p. m., July 22, for the construction of a graded school building. J. W. Richardson, Trustee.

Newberry, Ind.—Bids are asked by Wm. Neff, Trustee at Newberry, until 1 p. m., July 20, for the construction of a high school building. Separate bids on heating will be received.

Wabash, Ind.—Bids are asked by Commissioners of Wabash County, at Wabash, until 2 p. m., Aug. 6, for the installation of a heating plant in the Wabash County Court House.

Ames, Ia.—Bids are asked by A. H. Munn, Chairman Building Committee, until 12 noon, July 30, for the erection of the Methodist Episcopal church. Bids will be received on parts of work or as a whole. Brown & Davis, Architects, Cincinnati, O.

Kellogg, Ia.—Bids are asked by L. C. Watts, until noon, July 19, for erection of a school house in Richland Township, District No. 6.

New Orleans, La.—Bids are asked by Chas. R. Kennedy, City Comptroller, until 1 p. m., July 22, for the erection of a 2-story and basement school building in the square bounded by Felicity, St. Mary, Chippewa and Annunciation Sts. Plans, etc., with City Engineer.

New Roads, La.—Bids are asked by A. L. Jewell, Clerk of Court, until noon, July 25, for enlarging and remodeling a parish jail at New Roads. Plans and specifications may be seen at the office of A. L. Jewell, Clerk of Court, New Roads, La., or by applying to N. P. Phillips, Torras, La., or C. J. Hull, Architect, Alexandria, La. Each bid must be accompanied by a certified check for $1,000.

Flint, Mich.—Bids are asked by E. D. Black, Secretary of the Hurley Hospital Board, until 1 p. m., July 20, for erection and completion of hospital building, according to plans and specifications, which may be seen at the office of Black & Roberts, 404 Dryden Block, Flint, Mich., or at the office of Malcolmson, Higginbotham & Clement, Architects, 404 Moffat Bldg., Detroit, Mich.

Jackson, Mich.—Bids will be received at the office of the Architects, White & Hussey, Lansing, Mich., until noon, July 29, for the erection and completion of the superstructure of a brick church building for the Diamond Street M. E. Church Society. Rev. I. W. Minor, Pastor, Jackson, Mich.

Norway, Mich.—Bids are asked by Wm. R. Bolitho, City Clerk, until 8 p. m., July 22, for a complete steam-heating plant for the new city hall under course of erection; also the remodeling of heating plant in present old High School Building, as well as power house equipment for said work; also for all plumbing and sewerage for said city hall as per plans and specifications prepared for same by John D. Chubb, Architect, 816 Chicago Opera House Building, Chicago, Ill.

Owosso, Mich.—Bids asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., July 31, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Owosso.

Alexandria, Minn.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Aug. 19, for construction, including plumbing, gas piping, heating apparatus, electric conduits, and wiring of U. S. Post Office at Alexandria.

Jackson, Miss.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Aug. 22, for the construction of an addition to and the remodeling of the U. S. Postoffice and Court House at Jackson, Miss., including plumbing, gas piping, heating apparatus, electric wiring and conduits.

Cassville, Mo.—Bids are asked by W. T. Bailey, until July 20, for erection of church building here.

Newark, N. J.—Bids are asked by Board of Education, until 4:30 p. m., July 25, for material and labor for erection of Lincoln school house. Plans, etc., may be examined in the office of the Architect, Louis J. O'Rourke, Scheuer Building, 738 Broad St., Newark, N. J. Plans and specifications for heating and ventilating work may be examined at the office of the Consulting Engineers, Runyon & Carey, 122 Market St., Newark, N. J.

Brooklyn, N. Y.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., New York, until 11 a. m., July 22, for the following work: Installing additions and alterations to the heating and ventilating apparatus in public school 35, on Decatur St. and Lewis Ave., and public school 54, on Walworth St. near Myrtle Ave., Borough of Brooklyn; for alterations, repairs, etc., to public school 100, Truant School and Manual Training High School, Borough of Brooklyn.

Brooklyn, N. Y.—Bids are asked by Board of Health, 55th St. and 6th Ave., New York, until 9:45 a. m., Aug. 6, for furnishing and erecting all the materials necessary or required to erect and complete a fireproof office building at Willoughby and Fleet Sts., Borough of Brooklyn, City of New Yor.

New York, N. Y.—Bids are asked by John F. Ahearn, Borough President, until 2 p. m., July 18, for the completion of the plumbing and drainage of a public bath building now being erected on east side of Avenue A, between 23rd and 24th Sts., New York City, which has been abandoned by the original contractors. Security required is $3,000. Plans, etc., at office of Architects, Aiken & Brunner, 33 Union Square West, Borough of Manhattan.

New York, N. Y.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., until 11 a. m., July 22, for the following work: General construction, etc., of additions to and alterations in public school 4, on Rivington, Pitt and Ridge Sts., Borough of Manhattan; security required is $100,000; for installing electric equipment in addition to and alterations in public school 14, 225 East 27th St., Borough of Manhattan; for installing heating and ventilating apparatus in new public school 12, on northwest corner of Madison and Jackson Sts., Borough of Manhattan; for installing electric equipment in addition to and alterations in public school 29, on west side of Washington St., between Albany and Carlisle Sts., Borough of Manhattan; for heating, repairs, etc., of public schools 7, 44, 47 and 72, Borough of Queens; for installing heating and ventilating apparatus in new public school 88, on Elm Ave., Fresh Pond Road and Halsey St., Fresh Pond, Borough of Queens; for moving house, repairs, etc., at public school 52, Broadway, Academy and Vermilyea Aves., Borough of Manhattan.

Asheville, N. C.—Bids are asked by Mark L. Reed, Chairman, County Commissioners, until noon, Aug. 6, for the building of the annex to the county jail.

Bakersville, N. C.—Bids are asked by Joseph Bowditch, Chairman, Commissioner, until 10 a. m., Aug. 15, for labor and material for building court house at this place. H. L. Lewman, Architect, 1008 Lincoln Bank bldg., Louisville, Ky. The official advertisement will be found elsewhere in this issue.

New York, N. Y.—Bids are asked by Park Board, Arsenal Bldg., 5th Ave. and 64th St., until 3 p. m., July 25, for all labor and materials required for the erection of a new continuous skylight in the main roof of the east wing, the enlargement of the three dome lights over the Hall of Sculpture and the alteration of the cornice in the south gallery on the second floor of said east wing of the Metropolitan Museum of Art, located in Central Park. Security required is $15,000.

New York, N. Y.—Bids are asked by Robert W. Hebberd, Commissioner Public Charities, Foot of E. 26th St., until 2:30 p. m., July 22, for erecting of several rooms in connection with the Home for Aged and Infirm on Blackwell's Island. Raymond F. Almirall, Architect, 51 Chambers St., New York.

Hannaford, N. Dak.—Bids are asked by A. O. Anderson, Clerk, until Aug. 4, for the erection of a school building at this city.

Hurdsfield, N. Dak.—Bids are asked by School Board of Pleasant Valley School District No. 35, July 23, for the erection of a 4-room frame schoolhouse in this city. W. M. Thompson, Clerk.

Cleveland, O.—Bids are asked by Clerk Board of Education, E. 6th St., Cleveland, until noon Aug. 5, for material and labor necessary to complete the school building on S. 55th St., to be known as Technical High School.

Cleveland, O.—Bids are asked by A. R. Callow, Secretary Board of Public Service, No. 105 City Hall, until noon, July 23, for installing complete plumbing in the quadrangle building of the Cleveland Farm Colony at Warrensville, O. Certified check for $1,000 required with bid.

Lakewood, O.—Bids will be received by J. O. Gordon, Clerk Board of Education, of Lakewood Village School District, Cuyahoga County, Ohio, at the High School Building, Warren Road, until noon, Aug. 9, 1907, for all materials and doing all the work necessary for the construction of a public school building, to be located east of Ellbur Ave., in accordance with the plans and specifications for said building and work, on file in the office of L. W. Thomas, Architect, 942 Prospect Ave., S. E., Cleveland, O.

Marietta, O.—Bids are asked by W. J. Speer, Chairman Building Committee, until 12 noon, July 25, for the construction of an 8-story bank and office building and a 3-story building to be constructed at Marietta, O., for the German National Bank, in accordance with drawings and specifications prepared by Mills & Pruitt, Architects, Columbus, O.

New Lexington, O.—Bids are asked until July 20, for erection of a new brick school house in Sub-District No. 1. C. K. Wagner, Clerk.

Lincoln, R. I.—Bids are asked by Frank E. Fitzsimmons, Chairman School Committee, until 8 p. m., July 24, for the construction, heating and plumbing of the new Albion school house. Plans and specifications may be seen at the office of R. C. N. Monahan, Architect, 255 Main St., Pawtucket, R. I.

Newport, R. I.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 23, to perform the following work at the naval training station, Newport, R. I.: Schedule 41—Connection of officers' quarters with steam distributing lines. Schedule 42—Alterations to buildings.

Bowling Green, Va.—Bids are asked by J. L. White, Chairman Building Committee, until noon, Aug. 1, for furnishing materials and constructing a fireproof record room for this county. Information may be obtained from William C. West, Architect, 1103 East Main St., Richmond, Va.

Clarksburg, W. Va.—Bids are asked by Harvey W. Harmer, Secretary, until noon, July 24, for the construction of a stone church building for the Goff M. E. Church at Clarksburg, in accordance with drawings and specifications prepared by Mills & Pruitt, Architects, Columbus, O. Plans, etc., with architects and with Mr. Harmer.

Everett, Wash.—Bids are asked by Directors, Everett School District No. 24, Chas. E. Frost, Secretary, until July 22, for the erection of a school building to be known as the Washington school.

Halifax, N. S.—Bids are asked by G. E. Nichols, Secretary Committee, 48 Granville St., until Aug. 7, for construction of a stone cathedral in this city.

Roads and Streets

Items Arranged Alphabetically by States.

Oakland, Cal.—Bids are asked by John P. Cook, Clerk Board of Supervisors of Alameda County, at 10 a. m., until July 22, for the macadamizing of County Road leading from Mt. Eden to Alvarado, a distance of 3,000 ft.; plans and specifications are on file with County Clerk.

Champaign, Ill.—Bids are asked by Board Local Improvements, George C. Fairclo, Secretary, until 2 p. m., July 18, for improvement of Chalmers St., as follows: Excavation, 5,750 cu. yds.; curbing, 448 lin. ft.; combined curb and gutter, 5,800 lin. ft.; brick pavement, 8,075 sq. yds.; vitrified pipe drains: 1,344 lin. ft. 8 in., 440 lin. ft. 12 in., 460 lin. ft. 16 in., 446 lin. ft. 18 in.; 15-124 in. catch basins; 40 gutter plates.

Kangley, Ill.—Bids are asked by Highway Commissioners, Chas. W. Alberts, Chairman, of Town of Eagle, at Kangley, until 9 a. m., July 20, for constructing a gravel road commencing at the limits of the City of Streator, then running south in Section 35 of said town to the Livingston County line.

Des Moines, Ia.—Bids are asked by Board of Public Works, until 11 a. m., July 30, for the following work: Paving Court Ave., 11,213 sq. yds. block pavement; grading W. 10th St., 3,075 cu. yds.; paving E. 16th St., 2,224 sq. yds. vitrified block pavement; paving W. 5th St., 5,372 sq. yds., vitrified blocks; curbing W. 28th St., 1,190 lin. ft. Portland cement curb.

Cihcaga, Ill.—Bids are asked by Board Local Improvements, Room 216 City Hall, until 10:15 a. m., July 23, for the following street improvement work: Seven contracts for paving with asphalt, two contracts for paving with limestone, one contract for paving with granite blocks, one contract for paving with brick and two contracts for paving with creosoted wooden blocks.

Danville, Ill.—Bids are asked by Board Local Improvements, until 7:30 p. m., July 19, for curbing (1) Vermont St., (2) Voorhees St., (3) Iowa and other streets. Bond for $1.00 for each contract required.

Dixon, Ill.—Bids are asked by Board Local Improvements, until 2 p. m., July 10, for the construction of about 35,617 sq. ft. of cement sidewalk.

Frankfort, Ind.—Bids are asked by Commissioners of Tipton and Clinton Counties until July 22, for the construction of a joint gravel road running along the county line road. J. F. Barlow is Auditor Tipton County, Tipton, Ind., and C. F. Cromwell, Auditor Clinton County, Frankfort, Ind.

Greensburg, Ind.—Bids are asked by Commissioners of Decatur County, at Greensburg, until 1 p. m., Aug. 5, for the construction of gravel roads, 3½ miles in length, in Fugit and Jackson Townships. Frank E. Ryan is County Auditor.

Greencastle, Ind.—Bids asked by C. C. Hurst, County Auditor, until 11 a. m., July 27, for improvement of following macadam roads: Elmer E. Hurst, et al. road, Marion Township, 6,005 ft. long; John M. McElroy et al. road, Washington Township, 13,739 ft. long; H. G. Brown et al. road, Monroe Township, 9,011 ft. long; J. C. Butler et al. road, Greencastle Township, 11,434 ft. long.

Greencastle, Ind.—Bids are asked by C. C. Hurst, County Auditor, until 10 a. m., Aug. 11, for the construction of a road on the line between Putnam and Montgomery Counties.

Huntington, Ind.—Bids are asked by City Clerk, until 7 p. m., July 23, for construction of 5-ft. cement sidewalk on Condit St., J. B. Vernon, City Civil Engineer.

Sullivan, Ind.—Bids are asked by Commissioners of Sullivan County, at Sullivan, until noon, Aug. 5, for the construction of a gravel road 10,916 ft. long in Thurman Township. E. E. Russell is County Auditor.

Tipton, Ind.—Bids are asked by J. F. Barlow, County Auditor, until 10 a. m., July 26, for furnishing labor and material and the construction of the John B. Findley et al. gravel road No. 1, Cicero Township.

New Orleans, La.—Bids are asked by Chas. R. Kennedy, City Comptroller, until 1 p. m., July 22, for the following work: Subsurface drains, culverts, curbs and gutter bottoms, and sidewalk pavements, on Chestnut St. from Peters Ave. to Valmont St.; paving with bitulithic Perrier St. from Dufossat to Valmont St.; paving with asphalt Chestnut St. from Peters Ave. to Valmont St.; grading, curbing and artificial stone footwalks, square bounded by Joliet, Birch, Leonidas and Green Sts.; for subsurface drains, culverts, curbs and gutter bottoms and sidewalk pavements on Perrier St. from Dufossat to Valmont St.; repaving with square granite blocks Common St. from Magazine to Front St., with plans and specifications on file in the office of the City Engineer.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., July 18, for the following work: One contract for grading; four contracts for constructing brick pavement; one contract for constructing macadam; nine contracts for constructing artificial stone curbing.

Kansas City, Mo.—Bids are asked by Frank P. Gossard, Secretary Park Commissioners, until 3 p. m., July 22, for constructing artificial stone combined curb and gutter on Maple Boulevard; also for grading on Gillham Road.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., July 23, for grading Virginia Ave. from 39th St. to 42nd St.

Jersey City, N. J.—Bids are asked by Boulevard Commissioners of Hudson County, at 580 Newark Ave., Jersey City, N. J., until 3 p. m., July 25, for repairing the roadway on the sections of Hudson Boulevard.

Newark, N. J.—Bids are asked by Essex County Park Commission, 800 Broad St., until 3:30 p. m., July 30, for construction of 18,000 sq. yds. of 8-in. telford roadway at Weequahic Reservation, Newark, N. J. Plans and specifications can be examined and blank form of proposal obtained at the office of the Engineer, 60 Clifton Ave., Newark, N. J.

Rahway, N. J.—Bids are asked by County Road Committee, Court House, Elizabeth, N. J., until noon, Aug. 1, for constructing telford and macadam-stone roads on St. George Ave. and Leesville Ave., this city. The work includes the following: Earth excavation, 2,425 cu. yds.; earth embankment, 420 cu. yds.; 2-in. macadam pavement, 10,222 sq. yds.; 6-in. macadam pavement, 467 sq. yds.; 12-in. macadam pavement, 6,159 sq. yds.; 12-in. telford macadam pavement, 1,400 sq. yds.; crushed stone furnished additional, 700 tons; 3-in. drain tile, 4,000 lin. ft. Plans, etc., with Jacob L. Bauer, County Engineer, 215 Broad St., Elizabeth.

Owego, N. Y.—Bids are asked by Village Trustees, Wm. E. Barton, Clerk, until 8 p. m., July 22, for laying 10.000 sq. yds. of brick pavement on concrete base.

New York, N. Y.—Bids are asked by Commissioner of Docks, Pier A, Battery Pt., until noon, July 19, for furnishing all the labor and materials required for preparing for and laying asphalt pavement over the deck of the pier at the foot of West 22nd St., North River, over the new-made and in the vicinity of West 22nd St., North River, at the approach to the 39th St. Ferry terminal at Whitehall St., Borough of Manhattan, and at the approach to the Stapleton Ferry terminal at Staten Island.

New York, N. Y.—Bids are asked by Park Board, Arsenal Bldg., 5th Ave. and 64th St., until 3 p. m., July 25, for furnishing all the labor and materials necessary to pave with asphalt tiles the walks in Kings Park, Borough of Queens, together with all the work incidental thereto. Security required is $5,000.

Syracuse, N. Y.—Bids are asked by Board of Contract and Supply, George J. Metz, City Clerk, until 1:30 p. m., July 22, for the work under a number of contracts for constructing stone, cement and asphalt sidewalks.

Hamilton, O.—Bids are asked by Board Public Service, A. Rothwell, Secretary, until noon, July 18, for the improvement of North E St. from Milville Ave. to Elvin Ave., by grading and graveling, curbing and guttering and paving the sidewalk with cement.

New Bremen, O.—Bids are asked by A. M. Steinebrey, Village Clerk, until noon, Aug. 3, for labor and materials for improving portions of 1st St., Washington St., and Monroe St. by grading, setting curbing, and paving with vitrified or other hard, burned brick. Certified check for $500 for each street required with bid.

St. Clairsville, O.—State Highway Commissioner Huston, Columbus, O., is advertising two highways proposed under the new Ohio law for letting at St. Clairsville, Belmount County, Aug. 3. Specifications will be mailed to contractors upon request.

Olympia, Wash.—Bids are asked by this city until Aug. 5 for paving Main St. with brick, asphalt or other approved material. One-half mile of concrete curb and gutter, 2,000 lin. ft. of storm sewers, 8,000 sq. yds. of paving.

Steubenville, O.—Bids are asked by Board Public Service, T. W. Vance, Clerk, until noon, July 22, for constructing cement sidewalk on the north, east and west sides of city building. Certified check for $100 required with bid.

Steubenville, O.—State Highway Commissioner Huston, Columbus, O., is advertising a highway proposed under the new Ohio law, for letting at Steubenville, Jefferson County, Ohio, July 30. Specifications will be mailed to contractors upon request.

El Reno, Okla.—Bids are asked by L. G. Adams, City Clerk, until 8 p. m., July 25, for grading and paving with brick portions of seven streets and one alley.

Ashland, Ore.—Bids are asked by City Council, M. F. Eggleston, City Recorder, until 8 p. m., July 30, for labor and material for construction of 16,860 sq. yds. of macadam pavement, including grading and concrete curbs, gutters and crosswalks. Plans, etc., at office of City Recorder or at the office of Frank C. Kelsey, Civil Engineer, 504 Columbia Bldg., Portland, Ore.

Fort Greble, R. I.—Bids are asked by Capt. Willis C. Metcalf, Constructing Quartermaster, Fort Adams, R. I., until 10 a. m., July 31, for resurfacing of macadam roads and construction and repair of catch basins at Fort Greble, R. I.

Olympia, Wash.—Bids are asked by Joseph M. Snow, Secretary State Highway Board, until 2 p. m., July 27, for clearing, grubbing, grading and bridging that portion of the Lewis County section of State Road No. 5, lying between Stations 117 and 130, and between Stations 723+32 and 800. Bids are also asked for similar work on State Road No. 9.

Appleton, Wis.—Bids are asked by Board Public Works, E. L. Williams, City Clerk, until 5 p. m., July 26, for constructing 9 blocks of brick pavement and 6 blocks of creosoted wooden block pavement on College Ave.

Milwaukee, Wis.—Bids are asked by Board of School Directors, Frank M. Harbach, Secretary, until 4 p. m., July 18, for doing certain grading, graveling, sodding and cement work in and about public schools and grounds, in accordance with specifications and plans on file in the office of the Board of School Directors, 7th Floor, City Hall.

Shawana, Wis.—Bids are asked by D. E. Wescott, City Clerk, until 8:30 p. m., July 29, for paving portion of Main St. with brick and construction of gutters and curb.

Sewers.

Items Arranged Alphabetically by States.

Bradentown, Fla.—See Under Bids Asked Water Supply.

Chicago Ill.—Bids are asked by John J. Hanberg, Commissioner Public Works, until 11 a. m., July 23, for furnishing all labor and material and for building approximately 200 lin. ft. of 9-ft. sewer, including stone masonry outfall on pile timber foundation, in Canal Place, from west line of north branch Chicago River to near east line of Mendell St., making full and complete connection with the 9-ft. sewer now in Mendell St.

Pekin, Ill.—Bids are asked by Board of Local Improvements, until July 29, for a considerable amount of sewer work.

Waukegan, Ill.—Bids are asked by Board Local Improvements, Fred W. Churchill, Secretary, until 8 p. m., July 19, for the construction of a system of sewers in said city as follows: 200 lin. ft. 48-in. reinforced, 2,400 lin. ft. 48-in., 1,300 lin. ft. 36-in., 830 lin. ft. 30-in., 2.330 lin ft. 27-in. and 594 lin. ft. 24-in. concrete sewers; 1,375 lin. ft. 21-in., 1.230 lin. ft. 18-in., 2,740 lin ft. 15-in., 2.285 lin. ft. 12-in. and 3.380 lin. ft. 9-in. vitrified pipe sewers with necessary bulkhead manholes, etc., etc., in accordance with plans and specifications now on file in the office of M. R. Miller, Superintendent of Public Works.

Ames, Ia.—Bids are asked by A. B. Maxwell, City Clerk, who will receive bids until 8 p. m., July 18, for constructing sewers of about 2,900 ft.

Council Bluffs, Ia.—Bids are asked by W. F .Sapp, City Clerk, until noon, July 22, for labor and material for constructing sewers as follows: 2,985 ft. 8-in. pipe, 4,296 ft. 10-in. pipe, 2,622 ft. 2-in. pipe, 860 ft. 15-in. pipe, 1,584 ft. 18-in. pipe and 5,965 ft. 6-in. inlet pipe, and the construction of 28 manholes.

Des Moines, Ia.—Bids are asked by Board Public Works, until 11 a. m., July 30, for constructing about 1,321 lin. ft. of 12 in. vitrified clay pipe sewer in W. 5th St.

Bloomfield, Ind.—Bids are asked by Chas. E. Combs, President Board Trustees, until noon, Aug. 8, for materials and for construction of sewer system for this town. Plans, etc., at office of Town Clerk and at office of the Engineer, George C. Morgan, 169 Jackson Boulevard, Chicago, Ill.

Crawfordsville, Ind.—Bids are asked by Henry B. Hulett, City Clerk, until 7:30 p. m., July 22, for constructing sanitary sewer in Wabash Ave. Certified check for $1,000 required with bid.

Evansville, Ind.—Bids are asked by Board Public Works, Walter F. Wunderlich, Clerk, until 2 p. m., July 27, for the construction of a local sewer in and along 1st Ave. from Florida St. to a point 100 ft. south of 1st Ave. bridge.

Kansas City, Mo.—Bids are asked by L. A. Harper, City Engineer, until 11 a. m., July 18, for constructing district sewers in sewer district No. 297, in sewer division No. 5.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., July 23, for constructing district sewers in Sewer Districts Nos. 247, 215 and 15.

Newark, N. J.—Bids are asked by Street and Water Commissioners, City Hall, until 3:15 p. m., July 18, for construction of Meadow Brook sewer system, Sec. 1, the work including 3.907 ft. 18-in. double-strength pipe sewer, 320 ft. 12-in. deep and wide socket pipe sewer, 2,370 ft. 10-in. deep and wide socket pipe sewer, 7,120 ft. 8-in. deep and wide socket pipe sewer, 18,500 ft. 6-in. vitrified pipe house connections, 850 ft. 6-in. iron pipe house connections, 1,250 ft. 8-in. iron pipe, 3.000 ft. 8-in. underdrain, 68 manholes complete, including 17 junction and chimney manholes, two flush tanks complete, pumping station complete.

Plainfield, N. J.—Bids are asked by Common Council, James T. MacMurray, Clerk, until 8 p. m., Aug. 5, for the construction of sanitary sewers, including 20,227 ft. 8-in vitrified pipe sewer, 5 to 12 ft. deep; 2,148 ft. 10-in. vitrified pipe sewer, 5 to 13 ft. deep; 2,225 ft. 8-in. cast iron sewer, under 8 ft. deep; 995 ft. 10-in. cast iron sewer, 5 to 12 ft. deep; 54 manholes, 687 branches on 8-in. vitrified pipe, 60 branches on 10-in. vitrified pipe, 38 crosses and tees on cast iron pipe, 19 flush tanks, 2,785 ft. vitrified pipe house connections, 150 ft. cast iron house connections. Bids will also be received at same time for construction of following sewers: 2.543 ft. vitrified pipe, concrete or cement block sewer, 5 manholes, 20 branches, 12 in. Plans, etc., at office of Andrew J. Garnett, City Surveyor, 151 North Ave., Plainfield.

Brooklyn, N. Y.—Bids are asked by Bird S. Coler, Borough President, until 11 a. m., July 24, for the work under 18 contracts for constructing sewers. Largest contract calls for furnishing all the labor and material required for constructing sewer in 100th St. from Third Ave. to Fort Hamilton Ave., the work including 65 lin. ft. 15-in. pipe sewer, 1,185 lin. ft. 12-in. pipe sewer, 1,050 lin. ft. 6-in. house connection drain, 12 manholes, 1 sewer basin, 1,000 ft. (B. M.) sheeting and bracing, 5 cu. yds concrete cradle.

Buffalo, N. Y.—Bids are asked by F. G. Ward, Commissioner Public Works, until 11 a. m., July 26, for the following work: Constructing a 12-in. tile sewer in Richlawn Ave. between Leroy and Shawnee Aves.; constructing an 18 and 15-in. tile sewer in Jackson St. between Genesee St. and Court Place; constructing an 18 and 15-in. tile sewer in Durham Ave. between Delavan and Litchfield Aves.

Troy, N. Y.—Bids are asked by Board of Contract and Supply, James M. Riley, Clerk, until 11 a. m., July 19, for constructing 605 ft. of 20-in. sewer in Defreest Ave., 230 ft. of 8-in. sewer in alley and 420 ft. of 8 in. sewer in alley between 6th and 7th Aves.

Grand Forks, N. Dak.—Bids are asked by W. V. O'Connor, City Auditor, until 4 p. m., Aug. 5., for construction of lateral sewer in alley between International Ave. and Bridge Ave., in alley between 4th St. and 5th St., and in 3rd Ave. Certified check for $500 for each sewer required with bid.

Cleveland, O.—Bids are asked by A. R. Callow, Secretary Board of Public Service, No. 105 City Hall, until noon, July 24, for the construction of sewers and culvert in the following named avenues and roads between the points mentioned: Denison Ave., S. W., between West 98th St. and West 90th St.; Fulton Rd., S. W., between Hyde Ave. S. W., and Storer Ave. S. W. Woodland Ave. S. E., between Woodhill Rd., S. E., and City Limits; culvert over Kingsbury Run at East 79th St. across Minnie Ave. S. E.

New Bremen, O.—Bids are asked by A. M. Steinebrey, Village Clerk, until noon, Aug. 3, for furnishing labor and materials for improving Main St. by sewering, from the north side of Monroe St., thence north to the north side of Pearl St. Certified check for $500 required with bid.

Newcastle, Pa.—Bids are asked by A. F. Rhodes, City Clerk, until July 29, for constructing sanitary sewer in Edison Ave. Certified check for $100 required with bid.

Olympia, Wash.—See under Bids Asked, Roads and Streets.

North Milwaukee, Wis.—Bids are asked by Emil Klamp, Village Clerk, until 7:30 p. m., Aug. 5, for construction of 1,343 ft. of 6 in., 8,100 ft. of 8 in., 4,300 ft. 10 in., and 200 ft. 12 in. vitrified pipe sewers. The official advertisement will be found elsewhere in this issue and plans and specifications will be on file at this office.

Water Supply

Items Arranged Alphabetically by States.

Bradentown, Fla.—Bids are asked by Board of Bond Trustees, A. J. Beck, Secretary, until 10 a. m., July 25, for furnishing material and constructing waterworks and sanitary sewerage system, to include 183.3 tons cast iron pipe, 4 tons special castings, 10 fire hydrants, 22 valves and boxes, 1 500,000-gallon compound duplex pump, 1 boiler feed pump, 7½x5x6; 1 80-h.p. water heater, open pattern; 1 80-h.p. return tubular boiler; 1 100,000-gallon tank erected on steel tower 100 ft. high. Constructing reservoir, pumping station, pipe line, installing machinery, furnishing material and sinking 8-in. tubular well; furnishing and constructing approximately two miles pipe sewerage, with manholes, flush tanks, etc.

Fort Oglethorpe (P. O. Dodge), Ga.—Bids are asked by Capt. E. D. Anderson, Q. M., until 11 a. m., Aug. 8, for a deep well and water system at the Government Target Range at Catoosa Springs, Ga.

Cissna Park, Ill.—Bids are asked by H. B. Harvey, Village Clerk, until 8 p. m., July 25, for constructing 1,140 ft. of 4-in. water main.

Chesterton, Ind.—Bids are asked by Home Water Co., Chesterton, until July 20, for the construction of a waterworks system. Plans, etc., at Chesterton Bank.

Cherokee, Ia.—Bids are asked by D. W. McNeal, City Clerk, until Aug. 6, for constructing water mains extensions.

Decoroh, Ia.—Bids are asked by County Supervisors, I. Linnevold, County Auditor, until 1:30 p. m., Aug. 5, for the construction of a water system at the Poor Farm at Freeport, on either the automatic air pressure steel tank of 75 barrels, with 125 lbs. pressure to the inch, 12-ft. steel wheel, steel tower 70 ft. high and pump to complete the job, or 500 barrel tank overhead system, 60 ft. high.

Randolph, Neb.—Bids are asked by E. S. Maillaird, City Clerk, until July 22, for furnishing and laying 5,000 ft. of 4-in. cast water mains and 1,520 ft. of 6-in. cast water mains.

Fort Hancock (P. O. Sandy Hook), N. J.—Bids are asked by M. N. Falls, Constructing Q. M., until 2 p. m., Aug. 9, for installing filtration plant at Fort Hancock.

Irvington, N. Y.—Bids are asked by Board of Water Commissioners, Town Hall, Main St., until 4 p. m., July 23, for the furnishing and laying of about 3,000 ft. of 12-in. cast iron water pipe. James G. Orton, Clerk.

Jamestown, N. Y.—Bids are asked by Water Commissioners, Clement B. Jones, Secretary, until noon, Aug. 1, for furnishing material and labor in the laying of a water main of approximately 12,000 ft. of 16-in. and 750 ft. of 12-in. pipe in Jamestown. The work is divided into three classes, (1) the furnishing of all pipe and specials, (2) hauling of the materials from the railroad switch and delivering of same along line of trenching, (3) digging of trench, laying of pipe and back filling. (Advertised, Engineering-Contracting.)

New York, N. Y.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., until 11 a. m., July 22, for water main, etc., to building for Parental School, on westerly side of road between Flushing and Jamaica, about 1,700 ft. south of North Hempstead turnpike, Flushing, Borough of Queens. Security required is $4,000.

West Point, N. Y.—Bids are asked by Quartermaster, U. S. Military Academy, until noon, July 29, for the construction of two covered slow sand filters, each about ⅛ of an acre in extent.

..*Columbus, O.*—Bids are asked by Chas. E. Perkins, Chief Engineer, State Board Public Works, until noon, Aug. 13, for the construction of a reservoir in Summitt County. The work included about 17,000 cu. yds. of earth embankment, 24,000 ft. B. M. of timber and planking, 400 cu. yds. concrete masonry.

Hamilton, O.—Bids are asked by Board Public Service until noon, July 18, for furnishing materials, forms, tools, appliances, labor, transportation, hauling and erection for the chimney, receiving well and pipe and special castings, and the engine and boiler foundations, and all excavation and appurtenances in connection therewith. John W. Hill, Engineer, 506 First National Bank Bldg., Cincinnati, O.

Steelton, Pa.—Bids are asked by Jno. D. Young, Borough Secretary, until 7 p. m., Aug. 7, for the construction of a filter plant for Steelton. James H. Fuertes, Consulting Engineer, 140 Nassau St., New York City, N. Y.

Fort Adams (P. O. Newport), R. I.—Bids are asked by Capt. Willis C. Metcalf. Constructing Q. M., until 10 a. m., Aug. 5. for construction of 400,000 gallon reservoir, three shelters for springs, and the laying of pipes from springs to reservoir at Saunderstown, R. I.; also laying pipes from reservoir to and across Narragansett Bay to a connection with reservoir at Fort Greble, Dutch Island, R. I. Plans and specifications on exhibition here and in offices of depot quartermasters at Boston and New York.

Excavation—Earth and Rock

Items Arranged Alphabetically by States.

Norwalk, Conn.—Dredging.—Bids are asked by Maj. Harry Taylor, U. S. Engrs., New London, Conn., until noon, Aug. 12, for dredging in Norwalk Harbor, Conn.

Milner, Idaho.—Irrigation Canal.—Bids are asked by Paul S. A. Bickel, Chief Engineer, Twin Falls North Side Land & Water Co., Milner, until 3 p. m., Aug. 1, for the construction of 16 miles of canal containing about 30,000 perch of rough rubble masonry, 25,000 cu. yds. of lava rock excavation, 680,000 cu. yds. of earth embankment.

Chicago, Ill.—Dredging.—Bids are asked by Department Public Works, City Hall, until 11 a. m., July 23, for furnishing all labor, material, apparatus or thing required in doing and to dredge approximately 8,500 cu. yds. of material from the bottom of slip "A" of the west fork of south branch Chicago River.

Nevada, Ia.—Ditch Work.—Bids are asked by F. G. Dunahaugh, County Auditor, until noon, Aug. 2, for ditch work in Sec. No. 1, District No. 10.

Newton, Ia.—Ditch Work.—Bids are asked by J. A. Terry, County Auditor, until 3 p. m., Aug. 6, for the construction of ditch No. 13, in six sections, including open ditch and tile work.

Pocahontas, Ia.—Drainage Work.—Bids are asked by J. A. Terry, County Auditor, until 3 p. m., Aug. 6, for furnishing material and doing the work of constructing the drainage improvement in Drainage Improvement District No. 13. The work includes about 5 miles of open ditch, containing about 97,000 cu. yds., and 9½ miles of tile ditch, from 6 in. to 20 in. in diameter.

Greenfield, Ind.—Ditch Work.—Bids are asked by Oliver H. Monger, Superintendent of Construction, Room 1, Court House, until 2 p. m., Aug. 5, for the construction of a ditch, the work including the following: 2,657 ft. of 5-in. tile, 3,000 lin. ft. of 6-in. tile, 2,475 lin. ft. of 8-inch tile, 1,371 lin. ft. 16-in. tile, 1,448 lin. ft. of 10-in. tile, 3,770 lin. ft. of 12-inch tile, 4,096 lin. ft. of 14-in. tile. 1,448 lin. ft. of 16-in. tile and 1,780 lin. ft. of 20-in. tile. 2,105 cu. yds. of excavation (tile part), 4,179 cu. yds. of axcavation (open part), 1,715 cu. yds of filling, one retaining wall.

Lebonon, Ind.—Ditch Work.—Bids are asked by Oliver Clark, Superintendent of Construction of Boone County, at Lebanon, until 10 a .m., July 22, for the construction of a public ditch.

New York, N. Y.—Athletic Field.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., until 11 a. m., July 22, for the general construction, etc., of an athletic field at High School of Commerce on 65th and 66th Sts., west of Broadway, Borough of Manhattan. Security required is $1,800.

Miscellaneous

Items Arranged Alphabetically by States.

San Francisco, Cal.—Wharf Repairs.—Bids will be received at office of the Quartermaster, Depot of Recruits and Casuals, Angel Island, Cal., until 11 a. m., July 19, for furnishing all material and labor required in making repairs to wharf of iron standard piles at that post. Jno. L. Clem, Chief Q. M.

Chicago, Ill.—Conduit System.—Bids are asked by William Carroll, City Electrician, Room 12, City Hall, until 11 a. m., July 20, for constructing underground conduit systems for the Department of Electricity. All labor and material necessary to furnish and install a 6-duct conduit system on Wentworth Ave., between 35th and 63d Sts., consisting of approximately 18,600 conduit ft. and 47 manholes; also an 8-duct conduit system on Western Ave., between Blue Island Ave. and 35th St., consisting of approximately 4,799 conduit ft.; a 16-duct system from Western Ave. to the terminal station of the drainage canal of approximately 118 conduit ft. and a 6-duct system on Blue Island Ave., east of Western Ave., consisting of approximately 336 conduit ft. and 13 manholes.

Chicago, Ill.—High Pressure Piping.—Bids are asked by South Park Commissioners, E. G. Shumway, Secretary, 57th St. and Cottage Grove Ave., until noon, July 24, for high and low pressure piping for the new power station in Washington Park.

Chicago, Ill.—Screens and Galleries.—Bids are asked by Department Public Works, Room 224 City Hall, until 11 a. m., July 23, for furnishing all labor and material and for constructing and erecting complete the sewage screens, lifting apparatus, operating galleries, ladders and railings and other appurtenances in the Lawrence Ave. pumping station.

Jackson Barracks, La.—Wharf Repairs.—Bids are asked by Capt. B. T. Clayton, Q. M., New Orleans, until noon, Aug. 3, for repairing wharf at Jackson Barracks.

Baltimore, Md.—Refuse Removal.—Bids are asked by Board of Awards until 11 a. m., July 24, for the removal by scow or lighter and final disposition of street sweepings and other refuse. Specifications from J. L. Wickes, Commissioner of Street Cleaning.

New York, N. Y.—Freight Sheds.—Bids are asked by J. A. Bensel, Commissioner of Docks, Pier A, Battery Pl., until noon, July 26, for furnishing all the labor and materials required for preparing for and building freight sheds on piers Nos. 54 and 56, North River, between the foot of Little West 12th and West 14th Sts., on the Chelsea section, with lateral extensions on the adjacent bulkhead platforms. Security required is $220,000.

New York, N. Y.—Test Borings.—Bids are asked by James W. Stevenson, Commissioner of Bridges, Park Row Bldg., until 2 p. m., July 23, for making test borings at the site of a new bridge over the East River, between the Boroughs of Manhattan and Brooklyn. Security required is $5,000.

New York, N. Y.—Trolley Apparatus.—Bids are asked by James W. Stevenson, Commissioner of Bridges, Park Row Bldg., until 2 p. m., July 23, for the construction of trolley railway approaches to the Brooklyn Bridge, in the Borough of Brooklyn. Security required is $50,000.

New York, N. Y.—Removing Columns.—Bids are asked by James W. Stevenson, Commissioner of Bridges, Park Row Bldg., until 2 p. m., July 23, for removing columns at Sands and Washington Sts., in the Borough of Brooklyn, Brooklyn Bridge. Security required is $2,000.

Oyster Bay, N. Y.—Sea Wall.—Bids are asked by Wm. E. Luyster, Clerk County Supervisors, Mineola, N. Y., until 10 a. m., July 22, for the construction of sea wall along the harbor or east side of the West Shore road, in the Town of Oyster Bay. Certified check for $500 required with bid. William H. Seaman, Engineer, Glen Cove (L. I.), N. Y.

Hamilton, O.—Chimney.—See under Bids Asked, Water Supply.

Toledo, O.—Power Plant.—Bids will be received at the office of the Auditor of Lucas County until July 26 for labor and materials required in the building of a heating and power house for the Lucas County infirmary.

Brownsville, Pa.—Lock, Walls, Etc.—Bids are asked by Major H. C. Newcomer, U. S. Engrs., Pittsburg, Pa., until noon, Aug. 12, for building a lock with two chambers, two guide walls and two guard walls, at Brownsville, Pa., on the Monongahela River. The work to be done under the contract will cost over $400,000.

Tacoma, Wash.—Power Plant.—Bids are reported asked by Owen Woods, Commissioner of Public Works, until July 31 (extension of date), for the erection of a municipal power plant.

Materials, Machines, Supplies, Tools, Etc

Items Arranged Alphabetically by States.

Washington, D. C.—Steel Shelving.—Bids are asked by Elliott Woods, Superintendent U. S. Capitol Building and Grounds, until noon, July 31, for steel shelving equipment for the office of the Clerk of the Supreme Court of the District of Columbia.

Washington, D. C.—Valves, Tubing, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, until 10 a. m., July 23, to furnish at the navy yard, Washington, a quantity of naval supplies, as follows: Schedule 43—Trimming brass. Schedule 71—Valves, etc., the brass and copper tubing, etc., steel tubes, gauges.

Washington, D. C.—Pipe, Pumps, Rope, Etc.—Bids are asked by D. W. Ross, General Purchasing Officer, Isthmian Canal Commission, until 10:30 a. m., July 30, for furnishing, under canal circular 376, gasoline motor cars, electric fan motors, track scales, test pumps and gauges, iron pipe, steel, iron, rivets, nuts, nails, duck wagon covers, hemp rope, etc.

Chicago, Ill.—Pump Barrel, Etc.—Bids are asked by Department Public Works, Room 224, City Hall, until 11 a. m., July 23, for furnishing and delivering at the Harrison St. pumping station one new pump barrel and bottom made in three sections and one valve chamber.

Chicago, Ill.—Corporation Ferrules.—Bids are asked by John J. Hanberg, Commissioner Public Works, nutil 11 a. m., July 23, for furnishing and delivering to the city of Chicago approximately 5,000 ¾-in. corporation ferrules, according to plans and specifications on file in the office of the Department of Public Works, Room 325, City Hall.

Chicago, Ill.—Boilers.—Bids are asked by Business Manager Board of Education, Tribune Bldg., until noon, July 19, for furnishing boilers.

New Orleans, La.—Steam Hammer, Blower, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 23, to furnish at the naval station, New Orleans, La., a quantity of naval supplies, as follows: Steam hammer, blower, melting furnace. Applications for proposals should refer to schedule 45.

Boston, Mass.—Pulleys, Pipe, Drills, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 23, to furnish at the navy yard, Boston, Mass., a quantity of naval supplies, among which are the following: Schedule 76—Bolts and nuts, screws, emery cloth, pulleys, drills, taps, hack-saw blades, shovels, files, palms, hardware and tools. Schedule 78—Sheet brass and copper, rolled bronze. Schedule 79—Bar iron and steel, galvanized sheet steel, slab zinc, pig lead. Schedule 80—Gum gasket, hose. Schedule 81—Litmus paper, etc., paints, cylinder oil, acids, etc., bath brick, japan drier, turpentine, white zinc, beeswax, graphite. Schedule 82—Copper pipe, pipe fittings, valves.

Portsmouth, N. H.—Elevator.—Bids are asked by Bureau of Yards and Docks, Navy Department, Washington, until 11 a. m., Aug. 10, for installing an electric elevator, naval prison, navy yard, Portsmouth, N. H.

Portsmouth, N. H.—Milling Machine.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 23, for furnishing at the navy yard, Portsmouth, N. H., under schedule 45, milling machine, hydraulic accumulator.

Brooklyn, N. Y.—Top Soil.—Bids are asked by Park Board, until 2 p. m., July 25, for furnishing and delivering 12,000 cu. yds. of top soil or garden mold to Prospect Park. Blank forms may be obtained at the office of the Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn.

Brooklyn, N. Y.—Limestone.—Bids are asked by Park Board, 5th Ave. and 64th St., New York, until 3 p. m., July 25, for furnishing and delivering limestone and limestone screenings in parks in the Boroughs of Brooklyn and Queens. Blank forms may be obtained at the office of the Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn.

Buffalo, N. Y.—Hose, Cable, Fire Engines, Etc.—Bids are asked by Board of Fire Commissioners, until 3 p. m., July 19, for furnishing the following: Two first size steam fire engines of the piston style, f. o. b. cars, Buffalo; 5,000 ft. of 2½-in. internal measurements of cotton rubber lined fire hose; about 2,000 ft. 20-conductor cable; 50 miles of No. 10 B. & S. G. hard drawn copper line wire, 20 miles of No. 10 B. & S. G. hard drawn copper line wire, triple braided weather proof, 5 miles No. 10 extra B. B. galvanized iron telegraph wire, wire to be soft and pliable; 3 miles of twisted pairs No. 14 B. & S. G. hard drawn copper wire, all wire to be in half-mile coils.

New York, N. Y.—Ice Machine, Pipe, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 23, for furnishing at navy yard, New York, N. Y., a quantity of naval supplies, among which are the following: Schedule 45—Ice machines. Schedule 76—Hardware and tools, bolts and nuts, brass nuts, buckets, files, handles, chest and padlocks, steel wire and copper nails, hack-saw blades, scales, wood scrapers, screws, file brushes, phosphoro-bronze and brass wire, emery cloth. Schedule 77—Ash, oak, white pine, spruce. Schedule 78—Sheet brass. Schedule 79—Sheet lead, steel billets, bars and angles, sheet tin. Schedule 82—Iron or steel pipe, pipe fittings, gate valves. Schedule 83—Leather belting, side leather. Schedule 84—Iron castings.

New York, N. Y.—Fire Alarm Supplies.—Bids are asked by Francis J. Lantry, Fire Commissioner, 157 E. 67th St., until 10:30 a. m., July 24, for furnishing and delivering supplies for the fire alarm telegraph, Boroughs of Brooklyn and Queens.

Wahpeton, N. Dak.—Boilers.—Bids are asked by Wm. R. Purdon, City Auditor, until 8 p. m., Aug. 5, for construction and placing of boilers at city waterworks.

Charleston, S. C.—Motor Drive Outfits.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 23, to furnish motor drive outfits at the navy yard, Charleston, S. C. Applications for proposals should refer to schedule 72.

Norfolk, Va.—Wire, Pipe, Hose, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 23, to furnish at the navy yard, Norfolk, Va., a quantity of naval supplies, among which are the following: Schedule 44—Motor dory. Schedule 73—Fire brick, steel letters, sheet steel, sheet rubber. Schedule 76—Hardware and tools, torches, copper and phosphor-bronze wire, bolts and nuts, drills, files, screws. Schedule 77—Ash, white and yellow pine. Schedule 78—Rolled bronze, sheet brass. Schedule 79—Galvanized sheet steel. Schedule 80—Hose. Schedule 82—Brass pipe, brass pipe fittings, valves.

CONTRACTS LET,

Items Arranged Alphabetically by States.

Aurora, Ill.—Brick Paving.—Contract for paving with brick and curbing Jackson St. is stated to have been let to Salfisberg & Co., at $32,556.

Ottawa, Ill.—Sewers.—Green & Sons, Appleton, Wis., have been awarded contract at $196,690 for constructing west side sewer improvement.

Elkhart, Ind.—Sewer.—Contract for construction of the Indiana Trunk Line sewer was let to the Northern Construction Co. of Elkhart at $62,371.

Princeton, Ind.—Gas. Plant.—Practical Gas Construction Co., Chicago, Ill., has been awarded contract by Consumers' Gas Co. for construction of artificial gas plant here. Contract amounts to $60,000.

Waterloo, Ia. — Paving.— Contract has been awarded to W. A. Bryant & Sons of Waterloo for brick and asphalt paving in West Waterloo at $1.79 for asphalt and $2 for brick; 21,724 yds. asphalt and 4,556 yds. brick. Ten blocks of paving will be ordered additional.

Horton, Kan.—Sewers.—Contract for constructing 9,315 ft. of 8-in. lateral sewers for this city has been let to T. W. Roberts, Independence, Mo., at a total bid of $8,412. W. B. Hazen, C. E., St. Joseph, Mo., engineer for the city in this work, is also preparing plans and specifications for two lateral sewers for Hiawatha, Kan., and is making surveys to establish grade system for Conway, Ia.

Topeka, Kan.—Brick Paving.—H. N. Rice, St. Joseph, Mo., is stated to have been awarded an $88,000 contract for constructing brick pavement in this city.

Wellington Kan. — Railroad Work.— Atchison, Topeka & Santa Fe R. R. has awarded contract to Bancroft & Doty, Topeka, Kan., for betterment work on its line through this city. Contract amounts to about $440,000 and includes changing route of line so as to reduce a heavy grade.

Winfield, Kan.—Sewers.—Contract for constructing sewers for this city has been let to F. W. Yale, Coffeyville, Kan., for $26,483.

Baltimore, Md.—Clearing and Grading.—Lane Bros. & Jones are said to have been awarded contract for clearing and grading tract of land on Bach River, to be used for sewage disposal plant for this city. The contract amounts to $153,423.

Grand Rapids, Mich.—Bridge.—Joliet Bridge & Iron Works has been awarded contract for constructing bridge at Ann St., at $35,500.

Marquette, Mich.—Railroad Work.—Winona Mining Co. has awarded contract to James J. Byers & Co. of Houghton for the construction of two miles of railroad to run between the Winona mine and through the King Philip property to the Misery River.

Albert Lea, Minn.—Water Main.—Bids were opened June 29 for the construction of 2,786 ft. 6 in. water mains extension. Aug. Giesler, Albert Lea, Minn., was awarded contract, at $3,518. Other bids were as follows: W. C. Frazer, Rochester, Minn., $3,897; W. D. Lovell, Minneapolis, Minn., $3,800; J. W. Turner Improvement Co., Des Moines, Ia., $4,068.94; E. W. Knatvald and W. E. Bickford, Albert Lea, Minn., $5,565.08. Wm. Barneck is City Engineer.

Fergus Falls, Minn.—Dam.—Cortland F. Ames, Chicago, Ill., has been awarded contract for constructing dam for electric light plant of this city.

Eveleth, Minn.—Curbing.—City Council has awarded the contract for the laying of four blocks of curbing on Grand Ave. to J. D. O'Donnell of Duluth, for $3,348.

St. Paul, Minn.—Macadam Road.—Board Public Works has awarded contract for macadamizing and curbing University Ave. from Prior to Raymond to General Contracting Co. The city's portion of the improvement will cost $20,548 and the street railway company will probably let its own contract.

Vicksburg, Miss.—Brick Paving.—Additional contract has been let to Southern Paving & Construction Co. to pave with vitrified brick the extension on Washington St. from Harris to the city limits, to cost approximately $20,000.

St. Joseph, Mo.—Sewers.—Contract for constructing sewer in District No. 100 has been let to John Marnell at $3,303.

Springfield, Mo.—Brick Paving.—Contract for constructing 11,848 sq. yds. of brick pavement for this city has been let to Boyd Construction Co., Kansas City, Mo., for $19,312.

Niagara Falls, N. Y.—Electric Lighting System.—W. C. Thayer of East Aurora, N. Y., has been awarded the contract for completing the electric lighting system on the state reservation of Niagara Falls.

Syracuse, N. Y.—Asphalt Pavement.—Contract for constructing asphalt between Harrison St. and Euclid Ave. has been let to Central City Paving Co. at $32,438. The contract for the pavement between Harrison St. and Madison St. was let to Fred J. Baker, his bid being $5,521.

Dickinson, N. Dak.—Sewer System.—James Kennedy, Fargo, N. Dak., has been awarded contract at $26,000 for constructing sewer system here.

Fargo, N. D. — Sewers. — Contract amounting to about $16,000 for constructing sewers in Fargo Township has been let to James Kennedy.

Akron, O.—Paving.—Contract for the improvement of Miller Ave. from Main St. to the Akron-Barberton Belt Line R. R. by grading, curbing and paving was awarded to E. McSchaffrey & Son, at $11,258. The other bids were as follows: P. T. McCourt, $11,408; John J. O'Neil, $11,765. The material to be used is the Akron paving blocks.

Ashtabula, O.—Paving.—F. M. Kemp & Sons, Middletown, O., have been awarded contract amounting to about $51,000 for paving several streets here.

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COURT HOUSE.

Bakersville, N. C.

Notice is hereby given that the undersigned will receive until 10 o'clock a. m., on August 15th, 1907, sealed proposals for the furnishing of materials and performing the labor required for the building of a Court House at Bakersville, North Carolina, according to the plans and specifications which have been adopted, and are on file, and open to inspection, at the office of J. D. Braswell, Clerk.

All bids are to be delivered, sealed, to the Commissioners on or before the time named.

A certified check for 10 per cent of the total amount of the bid, payable to Jos. Bowditch, Chairman, must accompany each bid, such check to be forfeited to the county should the contract be awarded to the bidder and he fail within 30 days, after being notified, to execute a Surety Company Bond for the faithful performance of the contract based on his bid; such bond to be for double the contract price.

These bids shall be made out on the regular proposal blank, and no bids will be considered that are submitted in any other way than on the printed sheet, which must be without interlineations or changes. These bids will be received on the several systems, and items of construction, named in the specifications and proposals; however, the right is reserved by the Commissioners, to adopt the system of construction, and bid on that system, which they may decide to be to the best advantage of the County.

Bidders shall set forth in their proposal the number of buildings of this character erected by them, the cost of such buildings and their locations, as well as such other information as will establish the bidders' experience and qualifications.

The Contractors, to whom this work shall be awarded, must furnish evidence that he is skilled and experienced in fireproof floor construction. Favorable consideration will be given the bid of contractors so experienced and qualified.

The bidder must satisfy the Commissioners of his ability to furnish the materials and perform the work for which he bids.

The contract shall be let only as a whole; bids in detail will not be given consideration as it is the purpose of the Commissioners to hold one Contractor, or firm, responsible for the entire accepted work according to these specifications.

As a precaution against loss of time, each bidder should furnish with his bid, a letter from a Surety Company, stating that they will make, for the bidder, the requisite bond, guaranteeing the completion of the contract.

The contract price shall be paid and percentage shall be retained as provided for in the specifications.

The Surety Company Bond shall be on a bond blank similar to No. 203 G. of the Fidelity and Deposit Co., of Maryland.

The right is hereby reserved to reject any and all bids, or to waive defects in the same, if it be deemed in the interest of the County to do so.

Plans are also on file in the office of the Architect, H. L. Lewman, 1008 Lincoln Bank Building, Louisville, Ky.

JOSEPH BOWDITCH,
Chairman.

3-1t

VIADUCT.

East St. Louis, Ill.

Sealed proposals suitably endorsed on envelope will be received at the office of the Board of Local Improvements of the City of East St. Louis, Illinois, until 12 o'clock M., August 1st, 1907, for the rebuilding of the Broadway Viaduct in this city, according to the plans and specifications on file at the City Engineer's office. All proposals shall be made on blanks which shall be furnished at the office of the City Engineer. Each bidder shall deposit with his bid a certified check of $1,000.00, payable to the order of the President of the Board of Local Improvements of the City of East St. Louis, Illinois, to guarantee that the successful bidder will, within ten days, enter into a contract with the city, and within twenty days from the signing of the contract will execute a collateral or other bond to be approved, for the faithful performance of the contract in accordance with the plans and specifications.

Further information may be obtained at the office of W. J. Crocken, City Engineer, or at the office of Carl Gaylor, C. E., 900 Wainwright Building, St. Louis, Mo.

The city especially reserves the right to reject any or all bids.

W. J. CROCKEN,
3-2t City Engineer.

PROPOSAL FOR SEWERS.

North Milwaukee, Wis.

Sealed proposals will be received by Emil Klamp, Village Clerk, North Milwaukee, until August 5, 1907, at 7:30 p. m., for the construction of approximately 1,343 ft. of 6", 8,100 ft. of 8", 4,300 ft. of 10" and 200 ft. of 12" vitrified pipe sewers and 43 manholes. Each bid must be accompanied by a certified check for 5 per cent of the approximate amount of the bid. Plans and specifications will be on file after July 20 at the village hall, North Milwaukee, 31 Vroman Building, Madison, Wis., at the Builders' and Traders' Exchange, Milwaukee, Wis., and at the office of Engineering-Contracting, 355 Dearborn St., Chicago, Ill.

EMIL KLAMP,
3-2t Village Clerk.

WATER MAINS.

Jamestown, N. Y.

Bids Opened August 1, 1907.

Proposals are hereby solicited for the furnishing of material and performance of work in the laying of a water main, of approximately 12,000 feet of 16 inch pipe and 750 feet of 12 inch pipe, in the City of Jamestown, for said city. The work is divided into three classes (1) the furnishing of all pipe and specials, (2) hauling of the materials from the railroad switch and delivering of same along line of trenching, (3) digging of trench, laying of pipe and back filling.

Complete plans and specifications for the performance of each class of work are on file with the Water Department of the City of Jamestown, at its office in the City Hall. in said city, and will be furnished upon application, to prospective bidders.

Sealed proposals for the performance of any class will be received by the Board of Water Commissioners at its office aforesaid, until the hour of 12 o'clock, noon, of the 1st day of August, 1907, at which time all bids will be opened. The Board reserves to itself the right to reject any and all bids. A certified check of five per cent of the estimated gross amount of the bid must accompany the same, upon the terms and conditions specified in the proposal sheet.

Dated the 10th day of July, 1907.

BOARD OF WATER COMMISSIONERS,
By Clement B. Jones,
3-2t Secretary.

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CIVIL SERVICE EXAMINATIONS will be held at room 400, City Hall, Chicago, as follows: Mechanical and Electrical Engineers, grade 4, salary $1200 to $1400, July 22. Spelling, Penmanship, Arithmetic, Technical Knowledge and Experience. Open to residents of Chicago only. Mechanical Engineers, Board of Education, grade 10, salary $3000 or more, Sept. 28. Spelling, Penmanship, Arithmetic, Technical Knowledge and Experience. Residents of Chicago only. Architectural Draftsmen. Open to residents and non-residents of Chicago: Grade 5, salary $1400 to $1600, Oct. 1; grade 6 salary $1600 to $1800, Oct. 15; grade 4, salary $1200 to $1400, Oct. 30.

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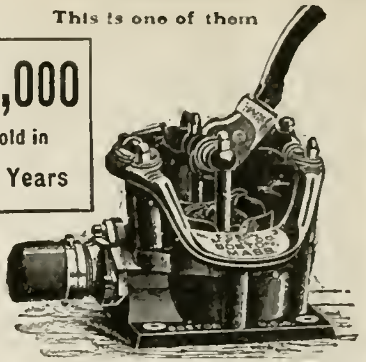

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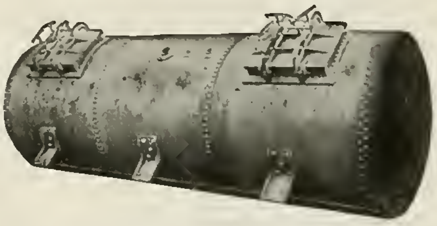

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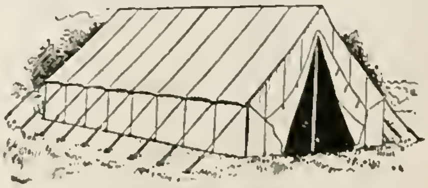

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Bucyrus 70 ton shovel (new)	9,900.00
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54x54x16 ft. stone planer	950.00
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12x12x14 Hall air compressor	650.00
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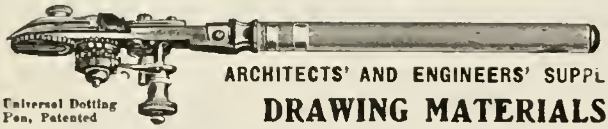

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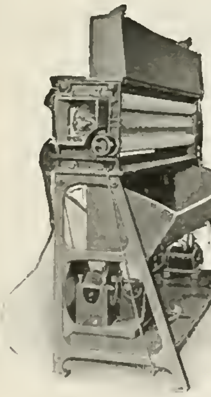

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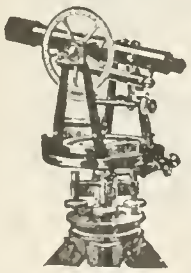

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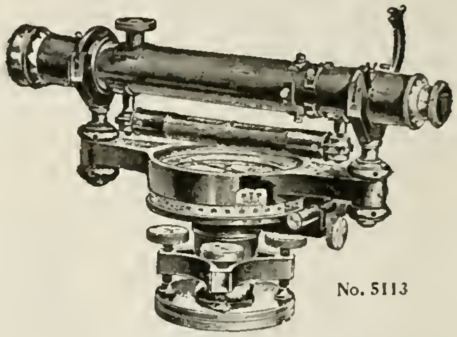

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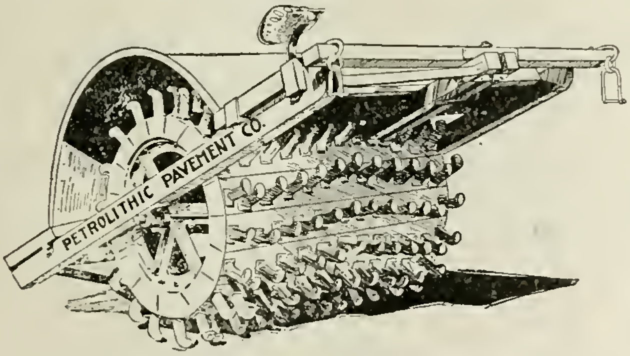
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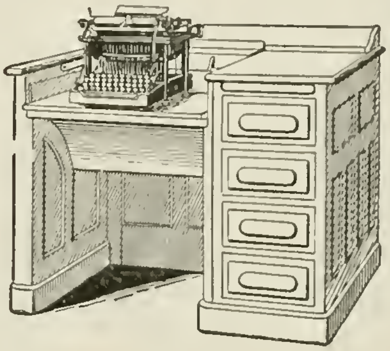

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Design of a Reinforced Concrete Building.

The attention of designers in reinforced concrete and particularly that of student designers is directed to the installment which we present in this issue of Mr. E. Lee Heidenreich's series of articles on reinforced concrete construction. The installment begins the work of designing a reinforced concrete building, which work will be completed in a future issue. The author announces a building of typical character and gives in detail his methods of designing and computing the foundations, walls, floors and columns. Few analyses as complete have appeared in print and we believe that the publication of this one will appeal to many of our readers.

Cost of Trenching and Pipelaying.

We publish in this issue the third of our series of articles on the cost of trenching and pipelaying for sanitary sewer construction. The present article covers 42 jobs of sewer work. The first article published in our issue of May 15, covered 18 jobs and the second article published in our issue of June 12 covered 38 jobs. The three articles therefore, give the readers of Engineering-Contracting the cost in detail of 98 separate jobs of trenching, pipelaying and back filling for pipe sewer work. It should not be forgotten that these figures are records of actual construction work and not estimates based on assumed conditions of work and assumed prices of labor and material. They are actual costs —not contract prices. Being what they are we recommend these articles to the attention of city engineers and contractors for sewer work. The series will be continued in future issues and will altogether cover some 226 separate jobs.

Some Early Surveyors.

The old-time surveyor encountered many difficulties and endured many hardships that the engineer of to-day is ordinarily not called upon to meet. The ease of communication, the facilities for traveling and the efficiency of the instruments of the present day have made many tasks easy which in earlier times were quite difficult. Every now and then before some engineering society a paper is read treating of the work of these surveyors of the olden times. Such a paper was read this spring before the Boston Society of Civil Engineers by Mr. Frank W. Hodgdon. The paper treated of the work of some early surveyors engaged in Massachusetts state surveys, a particularly interesting part of it being that devoted to the survey of the northern boundary of Massachusetts made in 1741. The survey was made as the result of a decree of King George II by which the northern boundary of Massachusetts was fixed as a line three miles distant from the north boundary of the Merrimac River from the sea to a point three miles north of Pawtucket Falls, and thence due west to his majesty's other possessions. The marking of the straight line west of the point three miles north of Pawtucket Falls, was done by Richard Hazzen in March and April of 1741, the country traversed being largely a wilderness and heavily wooded. The party consisted of Mr. Hazzen and six assistants and the line was run by an ordinary surveyor's compass, the measuring being done with the old-fashioned surveyor's chain. The distance was 110 miles each way and was done in 37 days.

The following extracts from Mr. Hazzen's diary as given by Mr. Hodgdon in his paper will show some of the difficulties encountered:

"Friday, April 10. This day we measured 2:1:20.

"*Remarks.* At the end of half a mile from where we set out this morning we came to Deerfield River, very high and steep mountains being on each side of it, and up and down the river as far as we could see. We met with great difficulty in passing that river, first attempting to wade, and one only got over, and then tried to raft, but it was so shallow in some places we could not use it, and at length we found a place where we all waded over, though with great hazard, the water ran so swift. The mountain on the west side was so steep that we could not carry the chain to measure, but in 4 or 5 hr. time, when we had ascended the top of it, we judged we had got forward on our course 40 poles and no more at the furthest. The snow this day was about 3 ft. deep, the weather fair and the wind northwest. At about sunset we left off measuring and built a fire on the snow and lodged by it.

"Thursday, April 16. We measured to Hudsons River 5:0.

"Observations. On a small mountain at 4 miles and 40 poles from where we began to measure this morning we had a fair view of the city of Albany bearing from us southwesterly and distant about 8 miles as we judged, and at the same time had as fair a view of the fall of the Mohawk River, called Cohoes or Great Falls above Albany, to our very great joy, and therefore named the hill Mount Joy, the said falls being distant from us 3 or 4 miles; from thence we kept our course to Hudsons River at about 80 poles from the place where the Mohawk River comes into Hudsons River. We went thence to Albany and tarried there that night. The trees standing in our line or near it are well marked, but could raise but few other monuments, the snow in most places having covered the stones. The rivers and streams and ponds are laid down in their proper places exactly where we crossed them, but out of sight altogether by guess. The mountains are laid down as much in form as I could, and many pretty exactly, but they being of such a vast extent it must not be concluded that they are all so perfectly done nor that they are all put down that came within sight.

"Saturday, April 25. I purchased a canoe at Dunstable and came down the Merrimack River to Dracut. We carried our canoe over Pentucket Falls Zechariah Hildreth, another of our company, stopt at Dracut, where he belonged. We came down the river thence to Methuen, where Mr. Caleb Swan, another of the company who belonged there, left us. The rest of

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us came to Haverhill about 8 or 9 o'clock, after a journey of 37 days, all in perfect health through God's goodness to us.

"Richard Hazzen.

"N. B.—The weather proved so favorable that we never stopped in the woods for any foul weather, nor did we make a camp any one night and stretched our blankets but three times all the journey, but lodged without any covering save the heavens and our blankets."

In 1825 the line east of the Connecticut River was resurveyed and the line marked by Hazzen found, and two years later granite monuments were erected to mark it. Subsequent surveys showed that none of the points of the 1741 survey were more than 1,530 ft. off the straight line.

In writing of early surveys it is not out of place to mention the work of the first president of the United States, George Washington. All histories in a general way mention his early career as a surveyor, but it is only until recently that much has been written about his work as a surveyor and civil engineer. In the last few years several articles dealing with his work in these lines have appeared in technical and general magazines. Among these is a paper by Mr. Herbert M. Wilson read at the Mount Vernon convention of the American Society of Civil Engineers.

In 1748 Washington, then but 16 years old, was employed by Lord Fairfax to survey certain portions of his estate in the Blue Ridge Mountains, and during the next four years he devoted his time to making surveys incident to land sales. He also had the general direction of Lord Fairfax's land office.

The first record of a survey made by George Washington is as follows:

"March y. 15th 1747-8. Survey'd for George Fairfax, Esqr. a tract of land lying on Cates Marsh and Long Marsh Beginning at three Red Oaks Fx on a Ridge the No Side a Spring Branch being corner to ye 623 Acre Tract & Extending thence No 30° Et 436 poles to a Large Hickory and Red Oak Fx near John Cozines house thence No 60° Wt 90 poles to a Large White Oak Fx Thence No 7° Et 465 poles to Long Marsh."

Another record of one of his survey made in 1749 is as follows:

"Survey'd for Richard Barnes, Gent of Richmond County a certain Tract of Waste and ungranted Land Situate Lying and being in the county of Culpeper and Bounded as followeth Bginning at three white Oaks in Normans Line and Corner Trees to (Aaron Pinson's now) Mr. Barnes's Land & extending thence No 42° 30′ Wt Ninety five Poles to a branch of Flat Run Two hund and Eighteen Poles to a large White Oak Corner to Norman, etc. . . . thence with his Line No 53° Et One hundd and Eighty Six Poles to the Beginning Containing Four Hundred Acres this Twenty Second Day of July 1749.

John Lonem } Cha Men.
Edward Corder }

Edward Hogan, Marker,
by
Washington S C C."

For the survey for Richard Barnes Washington received the sum of £2 3s 0d.

Washington was not only a land surveyor of exceptional ability, but in addition his work on exploratory surveying and the vast amount of important work which he conceived entitle him, according to Mr. Wilson, to rank as the first and one of the ablest civil engineers of America.

Methods and Cost of Constructing Six Crib Piers, Three Howe Truss Spans and One Steel Draw Span.

PART I.

THE PIERS.

Crib piers for railway and highway bridges possess the great merit of making it unnecessary to build coffer dams, and, on this account, have always been popular with Western engineers. During recent years, however, concrete piers, built within coffer dams, have become more common than crib piers. Nevertheless, there are many places where the crib pier is still the most economic pier that can be designed.

The bridge to be described in this article consists of three Howe truss spans of 150-ft. each, and a steel draw span almost 300-ft. long. It crosses a river near its mouth, where the tidal currents cause a daily rise and fall of several feet. The river is 19-ft. deep at extreme low tide, and the top of the piers is 40-ft. above the river bed.

With the exception of the pivot pier, which will be described separately, the piers were crib piers resting on piles. A description of the construction of one of these five piers will serve for the rest.

Each pier is supported by 52 piles driven 3 ft. c. to c. to a depth of 30 ft. Piles 60 ft. long were necessary, due to the depth of the water at high tide, and were sawed off 7 ft. above the bottom of the river, or 12 ft. below extreme low water. The driving was very hard, the bottom being of sand in which the average penetration of the pile was only 2 ins. under the blow of a 2,200-lb. hammer falling freely 20 ft. For sawing off the piles, a circular saw on a 40 ft. vertical shaft was used. The shaft was rotated by an engine mounted on a carriage movable in any direction on two tracks at right angles to each other, one track being above the other.

While the piles were being driven for a pier, the crib was constructed. Each crib consisted of a bottom, or floor, made of three solid courses of 12x12-in. timbers drift-bolted together, and on top of this bottom was built the crib proper. The bottom was built on shore and then launched. Then the crib was built of 12 x12's log-house fashion, on top of the "bottom" until it reached a height of 12 ft. The crib was then floated over the rest of foundation piles, and arrangements made to lower it upon the piles. To insure a steady and even lowering of the crib, without risk of capsizing, it was necessary to lower the crib by means of blocks and tackle fastened to two bents of guide piles, one bent on each side of the crib. Rock was dumped into the crib, and it was sunk until it rested on the piles. This left the upper course of timber above the level of low water, and in readiness to continue the building up of the crib to the desired height. The cribs were designed so that the load of the bridge came directly upon the rock filling in the crib, the intention being to build masonry upon the rock fill after the crib timbers above the water level have rotted out.

In this connection it is interesting to note that the crib timbers were compressed nearly 1-16 inch per ft. of height, after the load came upon the piers. Part of this compression was doubtless due to shrinkage of the timber upon drying.

We would offer a suggestion as to a possible improvement in this form of crib pier construction. Let the foundation piles and the crib be built, in the manner above described, up to the low water level. But from that level to the top of the pier, substitute reinforced concrete "timbers" in place of wood. These concrete "timbers" could be cast on shore, and made so as to interlock, forming a solid and durable outside wall. Loose rock filling and gravel could then be deposited inside this wall, thus giving the necessary stability to withstand the impact of ice and drift. A pier of this sort would be far cheaper than a solid masonry pier, but would possess sufficient stability and a durability equal to that of solid masonry. In pier building, it should be remembered, the engineer seeks to secure a mass that will resist impacts rather than a monolith of great strength.

Returning now to the methods used in this crib pier construction, one feature is worthy of particular note. A crib having a height two or three times greater than its width is very "cranky" when floating in the water. It tends to turn over, and this tendency is made serious where the tides are rising and falling. It was necessary to have one man in constant attendance day and night, tightening or loosening the guy-lines with the changes of water level.

Before placing the crib pier over the piles, riprap was deposited between them, and leveled off by a diver. After the crib pier was in place, riprap was piled all around the pier to a depth of 6 ft. above the river bottom.

The Pivot Pier.—This pier differed from the piers just described in that it was a stone masonry pier resting on a timber grillage on top of piles. There were 121 piles, driven 3 ft. c. to c., forming a square 32 ft. on a side. The piles were sawed off only 18 ins. above the river bottom.

Sawing them off so close to the bottom was a mistake, for it entailed a great deal of trouble in placing the grillage upon the piles. This was due to the fact that dirt lodged upon the tops of the piles after they were sawed off, making it necessary for a diver to clean the piles off. The driving of the piles 3 ft. c. to c. caused the bottom to rise 6 to 12 ins. Then the eddies formed by the projecting pile heads and by the draw protection caused the floating sediment in the river to deposit around and on top of the piles. To add to the difficulty, the contractor had unfortunately deposited some of the riprap immediately after driving the piles, and many of the stones had lodged on top of the piles.

In this connection we recall a similar experience arising from the deposition of sand around the piles while they were being sawed off, dulling the teeth of the saw and adding greatly to the expense of cutting off the piles. The eddy caused by the piles of the draw protection was largely accountable for the trouble. Finally a V-shaped wing dam of boards was built in the draw protection immediately above the site of the pier, and it served to divert the stream of sand and gravel that is constantly rolling along the bottom of a swiftly flowing river.

The lesson learned by such experiences is simple: Do not cut off piles less than 2 ft. above the bottom of a river, unless there is some excellent reason for so doing.

The grillage built for this pivot pier was 32 ft. square and 15 ft. high, made of 12x12-in. timbers laid solid and drift-bolted together, except in the three upper courses where the timbers were laid 2 ft. apart, and the space filled with concrete.

At the bottom of the grillage, two timbers in each course projected beyond the others, so that guy lines could be fastened to them, by which the pier was kept balanced during construction while floating on the rising and falling tides. The guy lines were fastened to two pile bents, one on each side of the pier, which, together with the pile bents of the draw protection, formed a square enclosure in which the pier was guided to the bottom.

Of course the grillage sank under the weight of the masonry which was built on top of it. This masonry was laid inside on "open caisson" built on top of the grillage, the "caisson" being octagonal in shape, made of 3-in. plank, and 16 ft. high. The plank was beveled on the outer edges to provide caulking seams. Two small gates were provided in the "caisson," so that, when the pier had set properly on the piles at low tide, water could be let into the "caisson" and left there until the pier was finished. Then the gates were again closed, the water pumped out, and the masonry was painted.

Cost of the Piers. The labor cost records were not kept in as great detail as one might wish, yet they possess considerable value. The quantities of materials and contract prices, however, will serve as an excellent guide, and are as follows:

Cost of the Piers.—The labor cost rec-

3,120 lin. ft piles (52) delivered at	$0.08	$249.60
3,120 lin. ft. piles driven at	0.20	624.00
54,000 ft. B. M. delivered at	$15.00	810.00
54,000 ft. B. M. framed and placed	11.00	549.00
4,000 lbs. iron at	0.03	120.00
8 guide piles delivered at	3.00	24.00
4,000 ft. B. M. falsework at	15.00	60.00
190 cu. yds. rock (crib fill)	2.00	380.00
580 cu. yds. riprap at	2.00	1060.00
5 cu. yds. concrete at	8.00	40.00
Total		$3,961.60

This is equivalent to $100 per lin. ft. of height of pier, since the piers were 40 ft. high above the bed of the river.

Cost of Pivot Pier.

7,260 lin. ft. piles (121) delivered at	$0.08	440.80
7,260 lin. ft. pile driven at	0.20	1452.00
162,800 ft. B. M. deliv. at	15.00	2442.00
162,800 ft. B. M. placed at	8.00	1302.40
7,200 lbs. iron at	0.03	216.00
16 guide piles at	3.00	48.00
13,200 ft. B. M. falsework at	15.00	198.00
318 cu. yds. masonry at	15.00	4,770.00
570 cu. yds riprap at	2.00	1140.00
Total		$12,009.20

This is equivalent to $300 per lin, ft. of height of pier.

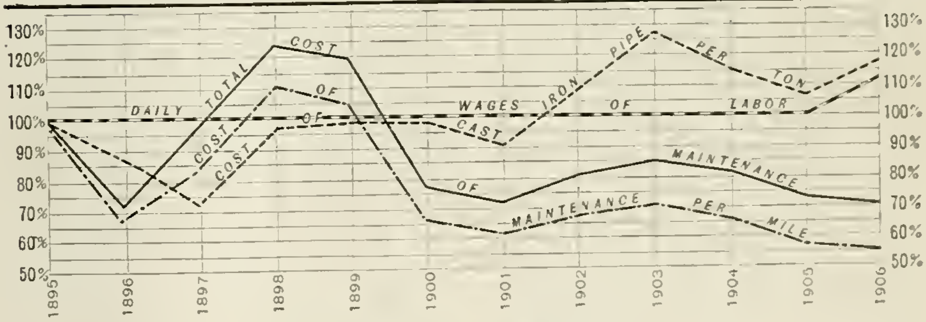
The contract price for driving the piles, 20 cts. per lin. ft., was high, considering the length of the pile, for it amounted to $12 per pile. But the driving was very hard, and the price for driving included cutting off the piles below water. It required 26 days to drive the 121 piles in the pivot pier and 10 days more to cut them off. Had a water jet been used the driving would have cost much less. The average rate and wages paid by the contractor for the pile driver crew was $2.50 per day. If a crew of 6 men, a pile driver engineman and a foreman were required, the wages and fuel amounted to $25 a day. Hence if 5 piles were driven per day the cost was $5 a pile. Since 12 piles were sawed off per day the cost of sawing was more than $2 per pile. No detailed records of the actual cost to the contractor are available further than that it required, 3,800 days' labor at $2.50, or $9,500 to drive the piles, frame and place the timber, place the crib fill and riprap for all the piers and lay the masonry. The stone for the masonry was delivered cut ready to lay. The riprap was delivered on scows and measured on the scows before placing.

For comparative costs, the reader is referred to our issues of Aug. 22, 1906 and May 8 and 15, 1907 which give in detail the actual cost of several piers built by the pneumatic caisson process, under conditions quite similar to those encountered in the work just described.

In our next issue will begin the methods and costs of erecting the three Howe truss bridges and the still draw span.

Cost of Water Pipe Maintenance.

The accompanying diagram and table give some interesting data on the percentage variations in cost of maintenance, labor and cast iron pipe for the water pipe systems of Chicago, Ill., for the period from 1895 to 1906. The data were compiled by the Division of Water Pipe Extension, Mr. W. A. Devering, superintendent, and were published in the report of the Department of Public Works for 1906:



Year.	Total Mileage of Pipe.	Total Cost of Maintenance.	Percentage variation Total Maintenance.	Average Cost of Maintenance Per Mile.	Percentage Varlation of Average Cost of Maintenance Per Mile.	Cost of Cast Iron Pipe PerTon.	Percentage variation in Cost of Pipe.	Daily Wages of Laborers.	Percentage variation Wages of Laborers.
1895	1612.3	$350,022.22	100.0	$217.09	100.0	$26.00	100.0	$2.25	100.0
1896	1691.2	252,458.44	72.1	149.28	68.7	23.00	88.4	2.25	100.0
1897	1730.3	317,823.92	98.0	183.68	84.6	19.00	73.0	2.25	100.0
1898	1801.2	433,994.45	123.9	240.89	110.6	25.00	96.1	2.25	100.0
1899	1846.9	419,132.15	119.7	226.95	104.5	25.50	98.0	2.25	100.0
1900	1872.0	269,649.63	77.0	144.04	66.3	25.50	98.0	2.25	100.0
1901	1890.0	250,591.95	71.6	132.59	61.1	23.50	90.4	2.25	100.0
1902	1918.7	267,788.25	79.0	144.27	66.5	28.00	107.7	2.25	100.0
1903	1939.7	294,499.66	84.1	151.83	69.9	33.00	126.9	2.25	100.0
1904	1978.2	280,363.69	80.1	141.73	65.3	30.00	115.4	2.25	100.0
1905	2038.5	252,093.39	72.0	123.66	56.9	27.50	105.8	2.25	100.0
1906	2073.2	243,334.02	69.4	117.37	54.0	30.00	115.4	2.50	111.1

Prices Used in Estimating Cost of Railways in Texas.

The Railroad Commission of Texas has appraised the value of roads recently constructed, using a schedule of unit prices which we reproduce herewith.

The railways were paying $1.50 to $1.75 per day of 10 hours for common laborers in 1906, and found labor very scarce at these wages.

The following unit prices were used in valuing the Trinity & Brazos Valley Ry., from Mexia to Houston, a distance of 165 miles:

	Price.
Right of way, per acre	$ 50.00
Depot grounds, per acre (minimum)	100.00
Reservoir grounds, per acre	25.00
Clearing and grubbing, per acre	25.00
Clearing and grubbing, per acre	50.00
Earth excavation, per cu. yd	0.15
Loose rock excavation, per cu. yd	0.40
Solid rock excavation, per cu. yd	0.75
Trestle timber, in place, per M	40.00
Trestle piling, in place, per lin. ft	0.40
Wood drain boxes, per M	35.00
Tile drains, 24 in., per lin. ft	3.00
Cattle guards, wooden surface	40.00
Fences, 4-wire, cedar posts (16 ft. apart), per mile of fence	160.00
Road crossings, per M	35.00
Ties, L. L. Y. pine (6"x8"x8')	0.70
Rails, 75 lb., per ton	35.00
Joints, including bolts, each	1.20
Spikes, 34 kegs per mile, per keg	5.25
Track laying and surfacing per mile	500.00
Car and engine hire during construction, per mile	250.00
Sidings (60-lb. rail, 2,640 ties per mile), per lin. ft	1.15
Switch furniture, per set	135.00
Ballast, sand (about 2,500 cu. yds. per mile), per mile	750.00
Telegraph line (for 1 wire, construction only, materials furnished by Western Union), per mile	50.00
Passenger depots, small frame, per sq. ft	1.00
Platforms for ditto, per sq. ft	0.16
Cotton platforms, per sq. ft	0.18

Engineering and legal expense, 5 per cent of total cost of construction.

Interest during construction, 5 per cent of total cost of construction.

For comparative figures the reader is referred to Lavis' "Railroad Location, Surveys and Estimates," page 193 et seq.

In subsequent issues we shall give in great detail the unit prices and itemized costs of the railways of the State of Washington, of which there are some 3,300 miles in operation, and about 1,000 more miles in process of construction.

The submarine boat Octopus in a submerge test on June 8, succeeded in reaching a depth of 207 ft., remaining submerged for 39 minutes.

The Itemized Cost of the C. M. & St. P. R. R. in South Dakota.

In the "Spokane Rate Case" before the Interstate Commerce Commission Mr. A. H. Hogeland, chief engineer of the Great Northern Railway, and Mr. W. L. Darling, chief engineer of the Northern Pacific railway, presented itemized estimates of the cost of reproducing those two railway systems. Acting for the city of Spokane, Mr. Halbert P. Gillette offered testimony showing that the estimates of Mr. Hogeland and Mr. Darling were too high. Among the facts most strongly in dispute was the allowance to be made for transporting the contractors' men and supplies over the railway to and from the site of the work. Mr. Hogeland testified that 4½ cts. per cu. yd. should be added to the contract price of each yard of earth excavation to cover the added cost to the railway company for transportation. Mr. Darling testified that 3 cts. per cu. yd. would cover this item and Mr. Gillette testified that 1 ct. would be an excessive allowance. In substantiation of his estimate Mr. Gillette presented data of his own and estimates made by other engineers. Among the latter was an estimate of Mr. D. J. Whittemore, made while he was chief engineer of the Chicago, Milwaukee & St. Paul. Mr. Whittemore presented his testimony in 1898 in the "South Dakota Rate Case" under conditions that made it desirable for him to claim all he reasonably could claim on the cost of construction of his road. His estimate covered the original cost of 1,101 miles of main line and 86 miles of sidetracks in South Dakota, which is equivalent to 1.08 miles of main line and sidings to each mile of main line. The unit prices used by Mr. Whittemore were based upon those prevailing in 1879 to 1887, the years during which the road was built. He testified that there was practically no rock excavation, which accounts in part for the low unit price in the earthwork.

Believing that Mr. Whittemore's estimate is worthy of being placed permanently on record in any engineering journal, we reproduce it herewith. In a subsequent issue we shall give Mr. Hogeland's and Mr. Darling's itemized estimates of the cost of the two great railroad systems of which they are chief engineers:

	Per mile of main line (1,101 miles).
11,300 cu. yds. embankment at 15.16 cts	$ 1,713.10
4.55 cu. yds. riprap at $1.50	6.80
10,000 ft. B. M. timber in bridges and culverts at $30 per M	300.00
425 lin. ft. piles in bridges at 35 cts	148.75
Truss bridges at $4,437 each	31.05
¼ iron pipe culvert in place of wooden one (betterment) at $50	12.50
96.63 tons (gross) rails at $46.76	4,518.40
7,555 lbs. track spikes at 2½ cts	188.90
380 pairs rail joint splices at $1	380.00
3,238 cross ties at 30 cts	971.40
0.63 switches at $100	63.00
0.01 railroad crossings at $200	2.00
1.08 miles main and side track laid and surfaced at $450	486.00
0.24 miles track ballested at $500	120.00
Moving track material from store depot to the front	140.00
9.92 miles fence at $1.40	128.80
29 panels (0.1 miles) snow fence at $2.10	60.90
260 ft. B. M. crossing plant (1.1 crossings per mile) at $20	5.20
1 cattle guard	10.00
Freight on track materials, ¾ ct. per ton mile	2,130.00
Freight on contractor's tools and supplies	7.50
Freight on contractor's teams	6.00
Freight on bridge and culvert material	99.00
Transportation of laborers, 6 men transported 500 miles to work at 2 cents per mile	60.00
0.23 station sign board, at $6.00	1.40
1.1 highway sign board, at $5.0	5.50
0.04 R. R. crossing sign board, at $6.00	.25
0.04 R. R. crossing stop board at $6.00	.25
2 whistle posts, at $1.00	2.00
0.45 mile posts, at $1.00	.45
1 rail rest, at $1.0	1.00
Buildings	855.00
1 mile right-of-way and station grounds	128.00
Telegraph lines	64.80
Engineering, superintendence, legal and general office expense	300.00
Interest on the above items for ½ of two years at 6%	777.00
Track tools, ⅛ section at $138 per section	17.25
Station furniture, 1/12 station, at $78	6.50
Betterment to roadbed and bridges, estimated at 5% of above	687.00
Stores and supplies	300.00
Total (exclusive of equipment)	$14,725.70

Mr. Whittemore testified that the $140 per mile for distributing track material from the store yard was estimated thus:

2 engines and crews at $25 per day	$50.00
36 cars at 50 cents per day	18.00
1 caboose	2.00
Total	$70.00

He stated that one-half mile of track was laid per day, hence it cost two times $70, or $140 per mile, to distribute track materials from the material yard.

It will be noted that the cost of transporting men and supplies, as given by Mr. Whittemore, consisted of three items, namely:

Freight on contractor's tools and supplies	$ 7.50
Freight on contractor's teams	6.00
Transportation of laborers	60.00
Total per mile	$73.50

This is equivalent to 2-3 ct. per cubic yard of earthwork if charged entirely to the earthwork.

The Mexican government is making arrangements to take control of lines of railway aggregating in length about 7,600 miles, with a network of rails extending from the capital to points on the northern border, where they connect with the railroads in American territory.

Methods and Costs, Some Old; Some New

Recovering Well Drill Point.—An electro-magnet was used in recovering a well-drill point from a well 540 ft. deep. The drill was 18 in. long, weighed 19 lbs. and had lodged crossways at the bottom of the hole. The magnet was constructed of a 3-in. steel shaft upon which was wound a 7-in. spool of No. 18 magnet wire, designed for a current of 220 volts.

Cost of Meter Maintenance at Rochester, N. Y.—The following matter on the cost of general expense of meter maintenance has been taken from a paper by Mr. Geo. W. Rafter on the cost of meters at Rochester, N. Y., read before the annual convention of the American Water Works Association. The table includes the cost of inspection of meter, general expense of maintenance, examination of metered services, cutting nipples and pipe, work of repair department, miscellaneous work, etc.

Year ending	Number of meters in use at end of year.	General expense of maintenance.	Expense per meter.
Apr, 3, 1893..	3,460	$2,550	$0.74
Apr. 2, 1894..	3,724	3,255	.87
Apr. 1, 1895..	4,043	3,359	.83
Dec. 31, 1895.	5,157	2,292	.44
Dec. 31, 1896.	6,005	3,929	.65
Dec. 31, 1897.	6,497	3,572	.55
Dec. 31, 1898.	7,227	1,437	.20
Dec. 31, 1899.	7,994	1,357	.17
Dec. 31, 1900.	8,752	1,184	.14
Dec. 31, 1901.	9,435	1,723	.18
Dec. 31, 1902.	10,310	1,713	.16
Dec. 31, 1903.	11,201	1,320	.12
Dec. 31, 1904.	12,260	1,101	.09
Mean..			$0.37

Grouting Masonry Piers.—Cavities amounting to nearly 27 cu. yds. were filled in bridge piers by grouting, the method of doing the work being as given below. The piers were built of massive gneiss blocks, bonded and partly held together by iron clamps. Smaller stones composed the interior of the piers and all cavities were filled with hydraulic mortar. In the course of time water penetrated inside the piers and began to form cavities. In order to remedy this a number of holes were made to open out all the internal cavities. These cavities were then scoured with a jet of water from a force pump. It was found that one hole communicated with a joint near the bottom of the lower end of the pier, the intervening distance being about 43 ft. with a fall of 10 ft. In each of three boxes equal parts of cement and sand were mixed dry, water was added, and the whole mixed into a uniform paste. Each batch was then emptied into a tank, and was kept thoroughly stirred until drawn off by a force pump and injected through flexible hose into the holes. It was necessary to empty the tank, pump and hose after each using, as otherwise the mortar would harden in them. The work was hard on the pump packings which wore rapidly and had to be renewed.

Barrels of Cement Per Cubic Yard.—In the construction of the Wachusett dam, for the Metropolitan Water and Sewerage Board, up to the end of 1905, there was used 81,103 bbls. of Portland cement and 182,480 bbls. of natural cement. All of the natural cement was of the Union brand and a large proportion of the Portland cement was of the Giant brand. The amount of cement used in the dam per cubic yard of rubble masonry, from the beginning of the work, according to the 5th annual report of the Metropolitan Water and Sewerage Board, was as follows:

Comp. of Mortar by Meas.	Bbls. of Cement Cubic Yard.	Cubic Yards built.
1 natural cement to 1 sand....	1.43	184
1 natural cement to 2 sand....	0.99	179,706
1 Portland cement to 2 sand...	1.07	31,884
1 Portland cement to 2½ sand.	0.86	8,927
1 Portland cement to 3 sand..	0.78	27,954

The amount of cement used in the dam, per cubic yard of each class of concrete masonry, has been as follows:

Comp. of Concrete by Meas.	Bbls. of Cement Cubic Yard.	Cubic Yards built.
1 natural cement, 2 sand and 5 stone	1.38	964
1 natural cement, 3 sand and 6 stone	1.15	18
1 Portland cement, 2½ sand and 4½ stone	1.36	7,107
1 Portland cement, 3 sand and 6 stone	0.99	1,464
1 Portland cement, 4 sand and 8 stone	0.70	172

Ventilation in Tunnel Excavation.—The Coquitlam tunnel of the Vancouver Power Co. has a total length of about 11,900 ft., and a normal sectional area of 73 sq. ft. The question of ventilating the tunnel as the work proceeded was solved by the installation of a 12-in. galvanized iron pipe, No. 24 gage, at a cost of 7½ cts. per lb. 40-in. fans, driven by 5 HP. motors, were placed at 2,000 ft. intervals, working in series, each fan forcing the air to the next one in the line. The speed of the fans was between 1,300 and 1,400 revolutions per minute and served to clear the tunnel of gas and smoke in 45 minutes after a blast. At the same time compressed air was blown through a ¼-in. opening into the face and aided in forcing the gas back to the end of the 12-in. ventilating pipe, which was kept about 100 ft. away from the face, out of reach of flying rock and debris. In the Cripple Creek District, Colorado, a tunnel, 9 ft. x 9 ft. in the clear, has been driven to a point about 8,500 ft. in a direct line from its portal. In this tunnel work the removal of powder smoke after shooting was also accomplished by means of a blower and the compressed air system. As soon as drilling was stopped the engineer would notice that the demand for compressed air had ceased, and he would then fill the receivers and pipe lines with air at 100 lbs. pressure. When the holes had been loaded and the fuses spit, the drillmen would open the gate-valve at heading and allow a full stream of air under the 100 lbs. pressure to play on the face through a 1-in. whistle cock. This volume of air stirred up the smoke and mixed thoroughly with it. The pressure in the pipe lines dropped rapidly, and as soon as it had reached 20 lbs., the compressor was started and the pressure kept at that point. The blower, if it was not already running, was also started. A 15-in. ventilating pipe was used, and it was seldom that the men could not get to the face within 20 minutes after a blast.

Hydraulic Grading.—In the construction of some river revetment work it was first necessary to grade the bank to a slope of 1 to 2, and this was done by the hydraulic process, a boat containing a force pump, a boiler and all necessary connections being used. The pump threw a stream of water through a 4-in. hose, on the end of which was a nozzle with a tip of 1¼-ins. diameter. A pressure of 100 lbs. per square inch was used, and the cutting stream threw all surplus material out in the river where it was carried away by the current. The nozzle was fitted with a lever and swivel, the pin of which was dropped into a piece of iron pipe previously driven into the ground, enabling the nozzleman to direct the flow to any point desired. When the upper bank had been graded and the surplus earth thrown out into the current, the nozzle was moved down the slope near the water surface, and the grading continued under water. The grading force consisted of 1 steam-engineman, 1 fireman 1 watchman, 1 nozzleman and 2 laborers who assisted him in shifting the hose between the nozzle and the pump. Under average conditions of soil and velocity of current in the river, about 800 cu. yds. of earth were moved per day of 10 hours.

Loans aggregating nearly $5,000,000 are to be made for the rebuilding of Kingston, Jamaica, which was destroyed by an earthquake. The British government intends to give the Colonial government the option of borrowing, for rebuilding purposes, $3,873,000, to be secured by the revenues of Jamaica. In addition to this loan the British government has consented to donate $730,000 and the people of England have subscribed $243,000, which would make a total of $4,866,000 available for relief. Of this, $973,000 is to be distributed for the relief of persons who were left destitute by the earthquake.

The military governors of Kirin and Heilungkiang, in Manchuria, are consulting with a view to building a railway line between Peituanlintzu, a place situated to the north of Harbin and Sanhsing, about 250 miles east of Sungari river, for which permission has been granted by the Chinese Board of Communication.

The Engineer As a Professional Man.[*]

BY GEORGE BENZENBERG.[†]

During no similar period in the history of engineering in this country have so many works of such gigantic magnitude, requiring the expenditure of such vast sums of money, been undertaken or entered upon as during the past year. Among these, the principal works, probably not over nine or ten in number, are all devoted to improving or enlarging present facilities for navigation, travel and commerce, or to providing new channels and new terminals for the accommodation of such, and involve the expenditure of nearly seven hundred millions of dollars, while nearly as large a sum is to be spent from public funds for the development or improvement of water supplies, the betterment of sanitary conditions, the reclamation of arid lands, and the construction or reconstruction of highways, bridges, and other public works for the health, relief, and convenience of man.

It is, however, not only the constantly increasing needs of commerce and transportation, and the comfort and welfare of the public at large, that engage the talent of the engineer. The prevailing tendency to acquire profit and benefit by the introduction of more economical processes of construction and manufacture, as well as by the reduction of wastes, makes it imperative to enlist his analytical and inventive skill and his trained and experienced judgment in almost every branch of human activity, and to secure his advice or approval in every important enterprise.

Hence, everywhere, immense interests and ever-increasing responsibilities are being entrusted to the engineer by private as well as corporate organizations, and so thoroughly has he been able to meet every expectation, to fulfill every obligation, and to demonstrate his ability to meet every emergency successfully, that his service is considered as so elementary, so absolutely essential, that his counsel is not only invariably sought in the line of design and construction, but very frequently also as to the possibility or probability of any undertaking becoming a profitable venture. This, of course, is not only true with reference to the engineer in America, but is equally true as to his connection with the industrial development in every other country.

It is in keeping with the world's practical grasping at every opportunity to profit by the knowledge of the highest and best exponents before entering upon or engaging in any great or important venture. These exponents, therefore, should not only be well informed, accomplished, and gifted in their calling, but they must also be the representatives of the very best and highest type of that which is implied by American citizenship. Besides being designers and constructors of work for the upbuilding of commerce and every other industry, they should also, to come up to the standard of the profession, become foremost and eminent among their fellow men.

When this high station has been reached by honorable and distinguished achievement, the world has always with delight exhibited its admiration and approval, and been pleased to honor the profession. This marked position of trust, influence, and eminence which the profession has attained so signally in the industrial world is undoubtedly due to the fact that engineering has become a science of the highest standard, wonderfully developed as such within the past century and especially during the last fifty years.

This development and progress has been particularly along the line which constitutes the very essence of engineering, and consists in establishing and advancing a thorough knowledge and understanding of the various properties of material, of the forces and latent energies of Nature, and of their economic and intelligent application to the needs and benefit of man. This present knowledge has been acquired by faithful and patient study, by close and careful investigation, by thorough and systematic experiments and tests, and by compiling and communicating the results thereof by reports and publications, in order that the profession might have the full benefit of such research and continue the same for the information and benefit of its members.

There was a time when such information was not to be had. The engineer had but two ways of acquiring professional knowledge, either as an apprentice to some one experienced in engineering, or by his own investigation and experiment, often made at the expense, and sometimes to the injury, of his employer. At the present time, the thoughts, works, and valuable experiences of engineers in every branch of the profession are preserved in the form of reports and papers, that not only describe but illustrates the work of which the author had charge or with which he was associated, and relate in detail the problems and often the difficulties which were encountered, and the manner in which they were successfully overcome. Add to this the thorough and practical discussion which papers of such character usually call forth, revealing often the very best experiences and practice of others, and you have a way of imparting and acquiring knowledge that was not much more than thought of fifty years ago.

Furthermore, the various engineering colleges and technical schools of to-day contain libraries whose shelves are stocked with treatises containing specific and valuable instruction in engineering, as well as with official reports on engineering work. They also possess complete laboratories, thus enabling the student in every branch of the profession to become at least somewhat familiar with the practical end of his study and to train his mind in the proper method of conducting experiments and of investigating and diagnosing the engineering problems which may present themselves, or which may be entrusted to his charge. Moreover, every engineer of to-day, besides his collection of books of reference, keeps himself supplied with all the current literature and with every report and article published pertaining at least to that branch of engineering in which he is especially engaged, in order to remain well informed and abreast with the current conception, practice, and experience of the craft.

The marvelously rapid progress made in every branch within the last 25 or 30 years is therefore directly due to the fact that all the learning and experience of the profession has, by it, been prepared and made readily accessible to the engineer and student, and has thereby enabled him to project and carry out his work in such a manner and with such favorable results as frequently to challenge the wonder and admiration of an appreciative nation.

To promote and foster this service further, and to maintain the high standard of the profession among its members, as well as in the estimation of mankind, the profession in our country organized this society, as well as many kindred associations relating to the different branches of professional work, for the advancement of the individual engineer.

To the younger generation of engineers, who have or have not had the benefit of a technical education, a membership in this and kindred societies is of inestimable value, for it affords them the opportunity not only of participating in practical discussions, but also of having access to valuable documents, papers, drawings, and publications, containing a great mass of information which otherwise is not to be had, and which the earlier engineers did not possess. The present very rapid and remarkable growth in the membership of this society demonstrates that this fact is now fully understood and appreciated.

This advantage will doubtless lead the younger engineer to still greater achievements in his time, providing he does not entirely lose sight of the fact, that, though at college he may have learned how to proceed to preliminary investigation and study, and how to apply his knowledge, he has not as yet, by practice or experience, acquired the requisite judgment or the necessary discernment and prudence so essential to success in designing and carrying out engineering works.

It may be properly stated, therefore, that the present-day engineer largely owes whatever success he may have achieved, or reputable position he may occupy, primarily to the advantage which the profession has accorded him, through the close study and diligent research of others who have preceded him and have given the benefit of their learning and experience to the craft, and to which he in turn has likewise added his share for the benefit and welfare of others who may follow.

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[*] Portions of presidential address at the annual convention of the American Society of Civil Engineers in the City of Mexico, July 8, 1907.

[†] Consulting Engineer, Milwaukee, Wis.

If this be true, and the engineer, because of this service and also the eminence of his profession, occupies to-day a higher position in the world and enjoys a standing and reputation which compares most favorably with that of any other profession, then the question very properly arises, what duty does he in return owe to the profession; what should be his attitude toward it and his brother engineer, and what position must he ever maintain before the community at large, in order to receive always the full confidence to which he and it should and must always be entitled? This query is a pertinent one, which no engineer should disregard or hesitate to answer.

The engineer who is true and loyal to the pure purposes and noble and lofty character of his profession will bring to it the love, pride, and enthusiasm to which it is justly entitled because of its mission and its achievements. His true devotion to duty allows no unworthy sentiment, interest, or motive to influence him in his professional counsel or work. He places his profession always above himself, and carefully avoids every connection with any undertaking of the integrity or honesty of purpose of which he entertains a doubt. He is mindful that every act of his shall reflect creditably and elevate the standing and reputation of engineering, nor does he hesitate to exert his influence, his power, or his authority against any questionable proposition.

With the prevailing and ever-increasing tendency of the present day to acquire wealth rapidly, many temptations are thrown in the way of the engineer. Individuals or corporations engaged in monopolizing natural or artificial advantages for selfish purposes, to the detriment of others, do not hesitate to seek the aid of the engineer in furthering their objects. They tempt him to close his eyes to questionable and reprehensible practices. The engineer who is the head of, or is employed in, a municipal or other government department, or who has charge of work executed under contract, is nearly always exposed to such temptation. Every kind of influence is brought to bear upon him to exercise the duties of his office or of his position for the benefit of some individual, party, or combination. It assumes every conceivable guise, and is frequently used in such an insidious manner that the unsuspicious mind is not aroused.

How often has not the engineer on municipal work been importuned to place the inspection of such work in the hands of some one whose sole qualification consisted in nothing better than the possession of political influence, and who was expected to be not over scrupulous in carrying out the instructions of the engineer? In such case there must be but one issue, consistent with self-respect and with the reputation of the profession, and it is a credit to the craft to state that it is not often that such issue is no raised and carried out by the engineer, though it may often produce temporary embarrassment to himself.

The element of loyality to duty, of absolute faithfulness to every honorable engagement, which is not infrequently ignored in many professional and business enterprises, must ever be a distinguishing characteristic of every member of this profession. No matter what may be thought, said, or done in any other walk of life, that much, at least, the engineer owes to his calling, which through its combined achievements reflects credit and reputation upon the individual. In whatever form his service is rendered, whether in an official or private capacity, it must be given with honesty of purpose.

The world must know that the engineer does not lend himself, his ingenuity, his skill, or his experience to aught by what is right, and that, having the privilege of declining, his acceptance of a commission means that he is not, knowingly, lending himself to any questionable undertaking, and that his sense of probity, his pride in his work, and his devotion to his profession rise above every other influence or consideration.

The engineer, therefore, must not regard his work only as the means for acquiring a competency, but he must bring to it an earnest enthusiasm which will pilot him safely past every temptation to ignore his duty. His sense of honor will guide him in avoiding errors, failures, and disappointments in his work, and cause him not to assume any obligations he is not qualified to fulfill, or which are at variance with professional propriety and dignity.

To his brother engineer he should always entertain the same candor, courtesy, and respect that he does toward the entire brotherhood; he should always be fair minded and honorable. His sense of justice and equity will never allow him for one instant to forget that he himself is not infallible, that there is often more than one way of solving a problem, and that the work of the "other" may be capable of as good results, with as high economy, as his own solution; nor will he forget that his fellow engineer has the absolute and unqualified right to receive the same consideration he would himself expect.

He will, with the innate spirit of a gentleman, honor and respect the opinion and judgment of his fellow engineer, if given in good faith, to the same extent that he values his own; for the argument and reasoning of the one may be as sincere and logical as that of the other, and may possibly be founded on as good or even better experience, the relative merits of which can only be determined by unbiased consideration. He should also recognize that the reputation of the individual is inseparably linked with that of the profession, that the honor and glory of one reflects upon the other, and that, therefore, by maintaining the standing and reputation of its members, he is but maintaining his own. The respect and esteem which a community entertains toward any profession or its members is always in proportion to that which the members of such profession entertain toward one another.

Unfortunately, there are those who do not hesitate to presume upon the general confidence accorded by the community to any profession, and to exploit it or its reputation for purely personal profit and gain. In the other professions the law has been invoked to provide protection against the unauthorized acts and unprofessional practices of members or individuals whose dealings and transactions tend to reflect discredit upon their several occupations.

Happily, there has been no necessity for the enactment of any special statute to protect a community against imposition from the engineer or from one who claims to be a member of our profession, probably because his deeds and works speak for him, while his misdeeds, advertise themselves with surprising rapidity.

The engineer is not infallible; he may make mistakes, and it would be remarkable indeed if he did not at some time err in his judgment; but, so long as he is conscientious, exercises every care, and exhausts all his resources in the performance of his obligations, it cannot be said that he is culpable or negligent in his duty. It is necessary, therefore, that he should always be circumspect and vigilant. That the engineer has recognized these obligations toward his profession is evidenced by his standing in the community to-day, and by the trust and confidence with which every material development has been committed into his hands.

It is not the object to applaud our own work, but to resolve that the engineer shall ever be found worthy of every trust, equal to every emergency, and imbued with the lofty spirit and noble purposes of the profession, with the understanding that it is his misson to study and utilize the elements and forces of Nature in such a way that they will become the agents through whuch he may contribute his share in the universal upbuilding of a higher civilization.

Though, during the brief period in which engineering has become recognized as a most important factor in this work, an advance has been made greater than all the wisdom of previous ages could conceive, it is probable that not much more than the portal of that temple of fame has been reached wherein the full knowledge of the occult forces and secrets of Nature yet lie concealed.

Cost of Trenching, Pipelaying and Backfilling for Pipe Sewer Construction at Laurel, Miss.

In constructing some 17,000 ft. of 8 to 20-in. pipe sewer at Laurel, Miss., careful records of cost were kept by Mr. M. A. Hall, Centerville, Iowa, engineer in charge. From these records kindly furnished by Mr. Hall we have compiled the accompanying tables. The work comprised 43 separate jobs or sections of sewer construction and the tables give the total man hours and the man hours per lineal foot of sewer for each class of labor for each of 42 jobs. They also give a summary of the labor and other costs of this work per lineal foot of sewer. The itemized costs per lineal foot for each class of labor cannot be worked out from the records as furnished us for the following reason.

The wages were variable and were scaled. Foremen were paid $3, $3.25 and $4 for eleven hours part of the time and ten hours the balance. Laborers were paid $1.25 and $1.50 part of the time for eleven hours and part of the time for ten hours. The pipelayers were paid $2 for eleven hours at first and later for ten hours. The water boy was paid 50 cts. per day. The changes in wages and working days were not permanently recorded, making it impossible to itemize the labor costs. These changes were, however, taken into account by the engineer in figuring the summary of costs for each job. In further reference to the labor, it may be noted that southern negroes were employed and the work was done under inefficient foremen with the exceptions of jobs 7 ,11, 15, 16, 17 and 23 which were well managed. These six exceptional jobs represent, therefore, more nearly what work would actually cost when pushed by a hustling foreman.

Mr. Hall describes the method of collecting the original data as follows:

"In the first place the account of the labor was kept by the inspector of the work and he had his instructions to be careful to account for all the men and where they worked. He was furnished with a blank and was required to turn these reports over to the engineer in charge each morning as he came on the work, of course turning in the report that covered the previous day's work. Together they would look over the report and make such corrections as might be necessary while the conditions were still fresh in mind. In this way what was considered to be an accurate account of the labor was obtained in a classified form so that by applying the wage per hour the daily cost could be readily obtained. However, no attempt was made to keep the actual cost for each day. It was kept rather by sections, as will be shown by the table to follow. Such other data as called for on the inspector's blanks were also obtained by the inspector each day. In but one or two instances did I have any trouble in getting accurate accounts from the inspectors, for while it may seem strange to some, almost without exception the inspectors semed to consider it a pleasure as well as a duty to take an interest in these reports. They received no compensation for this extra work. An important advantage in keeping the work by blocks or sections is evident, for in this way a good record could be kept of the kind of material excavated and its condition relative to easy or difficult moving. This part of the data was largely kept by myself and from my personal observation.

"Of course there are always labor costs to the contractor which do not come under the observation of the inspector and it is hard for anybody except the contractor himself to know what these costs are and many times he could not separate these incidental costs, such as handling tools, unloading and hauling materials, moving materials from place to place in order to use up all odds and ends possible, and various other minor costs. Hence it is very possible that labor costs deduced from these figures should be increased by some percentage which I would estimate at 10 per cent for the average case."

	JOB I.		JOB II.		JOB III.		JOB IV.		JOB V.		JOB VI.	
Size of pipe, inches	20		20		18		18		18		18	
Length of pipe, feet	3600		475		250		440		545		470	
Depth of trench, feet	6.3		7.5		10.7		13.4		11.2		10.4	
Width of trench, inches	36		36		36		36		36		36	
Excavation per lin. ft. of trench, cu. yds	0.7		0.833		1.19		1.49		1.244		1.155	
TRENCHING:—	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.
Top men, common	....	......	....	.....	....	..	162	0.36818	140	0.25688	132	0.28085
Top men, convict	.	..		..	.	..	38	0.08636	66	0.12112	65	0.13830
Bottom men, common	2000	0.5555	685	1.4421	1180	4.72	385	0.875	423	0.77615	270	0.57446
Bottom men, convict	2057	0.5714	..		.	.	781	1.775	954	1.75046	602	1.28085
Bailing	7	0.0019	54	0.1137	11	0.044	36	0.08182	24	0.04403	14	0.02979
Bracing	6	0.0017	41	0.0863	94	0.376	46	0.10455	132	0.24220	31	0.06596
Scaffolding	..	...	.	...	..	..	177	0.40227	137	0.25136		......
Total labor trenching	4070	1.1305	780	1.6421	1285	5.140	1625	3.69318	1876	3.44220	1114	2.37021
PIPELAYING:—												
Pipe layer	214	0.0594	42	0.08842	29	0.116	50	0.11364	28	0.05138	19	0.04043
Pipe layer's helper	632	0.1756	125	0.26316	79	0.316	104	0.23636	83	0.15229	67	0.14255
Total labor pipe laying	846	0.2350	167	0.35158	108	0.432	154	0.35	111	0.20367	86	0.18298
BACKFILLING:—												
Team and one man	132	0.0367	21	0.04421	...	.	3	0.004545	42	0.07706	5	0.01064
Teamster's helpers	323	0.0897	3	0.00632		..	2	0.004545	84	0.15413	10	0.02128
By hand	430	0.1194	212	0.44631	219	0.876	408	0.927273	221	0.40550	392	0.83404
Total labor backfilling	885	0.2458	236	0.49684	219	0.876	412	0.936363	347	0.63669	407	0.86596
DRAYAGE:—												
Man and team	333	0.0925	21	0.04421	24	0.096	10	0.022727	8	0.01468	10	0.02128
Helpers	149	0.04139	3	0.00632	24	0.096	10	0.022727	11	0.02018	10	0.02128
Total labor drayage	482	0.13389	24	0.05053	48	0.192	20	0.045454	19	0.03486	20	0.04256
GENERAL SERVICE:—												
Foreman	172	0.0478	40	0.08421	137	0.548	32	0.072727	65	0.11926	48	0.10213
Water boy	290	0.0805	50	0.10526	133	0.532	62	0.140909	80	0.14679	48	0.10213
Clearing right of way	592	0.1644	8	0.01684	...	....	....	....	....	....	..	....
Total labor general service	1054	0.2927	98	0.20631	270	1.08	94	0.213636	145	0.26605	96	0.20426
Grand total labor	7337	2.03789	1305	2.74947	1930	7.72	2305	5.23863	2498	4.58347	1723	3.66597
Labor hours per cu. yd., trenching	1.615		1.97		4.32		2.48		2.76		2.05	
Labor hours per cu. yd., backfilling	0.351		0.597		0.736		0.628		0.512		0.75	
Feet of pipe laid with one barrel of cement	100		100		100		100		100		100	
SUMMARY OF COSTS:—												
Labor per lin. ft. of sewer	$0.31		$0.388		$0.956		$0.74		$0.671		$0.528	
Cost of pipe per lin. ft.	0.52		0.52		0.39		0.39		0.39		0.39	
Cost of sand and cement per lin. ft.	0.025		0.025		0.025		0.025		0.025		0.025	
Total cost per lin. ft.	0.855		0.933		1.371		1.155		1.086		0.943	
Contract price per lin. ft.	0.871		0.871		0.795		0.795		0.795		0.79	

Job 1. Dry 1,500 ft., sandy loam 2,100 ft. for most part heavy stiff bluish clay. Job 2. 275 ft. stiff bluish clay, 200 ft. had pockets of quicksand. Rain caused caving ditch. Job. 3. 4 Ry. tracks hard yellow clay top 6 ft., rest sand, water in bottom. Job 4. Top 10 ft hard yellow clay, rest to bottom sandy, 8 in. to 10 in. ground water. Job 5. Mottled clay, very hard and dry. Job 6. Mottled clay, very hard and dry.

	JOB VII.		JOB VIII.		JOB IX.		JOB X.		JOB XI.		JOB XII.	
Size of pipe, inches	18		8		8		8		15		8	
Length of pipe, feet	333		463		490		550		358		502	
Depth of trench, feet	9.5		9.2		5.6		7.5		10.7		8.7	
Width of trench, inches	36		24		24		24		34		28	
Excavation per lin. ft. of trench, cu. yds.	1.0555		0.6813		0.4148		0.555		1.1228		0.75185	
TRENCHING:—	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.
Top men, common	89	0.26726	64	0.13823	....	....	14	0.02546	240	0.67039	52	0.10358
Top men, convict	34	0.10210	29	0.06263	....	....	49	0.08909	57	0.15922	35	0.06972
Bottom men, common	297	0.89189	471	1.01728	360	0.74694	108	0.19636	703	1.06369	428	0.85258
Bottom men, convict	361	1.08408	280	0.60475	....	....	542	0.98545	236	0.65922	484	0.96413
Bailing	....	....	4	0.00864	....	....	....	....	29	0.08100	98	0.19521
Bracing	13	0.03904	....	....	....	....	....	....	25	0.06983	60	0.11952
Scaffolding	....	....	....	....	....	....	....	....	6	0.01676		..
Total labor trenching	794	2.38437	484	1.83153	366	0.74694	713	1.29636	1296	3.62011	1157	2.30474
PIPELAYING:—												
Pipe layer	18	.054054	26	0.05616	17	0.03469	18	0.03273	65	0.18156	56	0.11155
Pipe layer's helper	65	.195195	43	0.09287	31	0.06327	46	0.08363	102	0.28492	102	0.20318
Total labor pipe laying	83	.249249	69	0.14903	48	0.09796	64	0.11630	167	0.46648	158	0.31473
BACKFILLING:—												
Team and one man	6	.018018	4	0.00864	4	0.00816	22	0.0400	11	0.03073		....
Teamster's helpers	12	.036036	8	0.01728	4	0.00816	44	0.0800	22	0.06145		
By hand	210	.630630	244	0.52699	120	0.24490	62	0.1127	172	0.48045	285	0.56772
Total labor backfilling	228	.684684	256	0.55291	128	0.26122	128	0.2327	205	0.57263	285	0.56772
DRAYAGE:—												
Man and team	4	.012012	10	0.02159	4	0.00816	3	0.00545	5	0.01397	8	0.01593
Helpers	12	.036036	16	0.03456	4	0.00816	8	0.01455	5	0.01397	8	0.01593
Total labor drayage	16	.048048	26	0.05615	8	0.01632	11	0.02000	10	0.02794	16	0.03186
GENERAL SERVICE:—												
Foreman	25	.075075	55	0.11879	30	0.06122	18	0.03273	95	0.26536	61	0.12151
Water boy	20	.060060	28	0.06047	12	0.02449	17	0.03090	62	0.17318	2	0.00398
Clearing right of way	....	....	....	....	....	....	....	....	124	0.34637	....	....
Total labor general service	45	.135135	83	0.17926	42	0.08571	35	0.06363	281	0.78491	63	0.12549
Grand total labor	1166	3.50150	1282	2.76888	592	1.208	951	1.72905	1959	5.47207	1679	3.34454
Labor hours per cu. yd., trenching	2.26		2.688		1.801		2.336		3.224		3.065	
Labor hours per cu. yd., backfilling	0.649		0.8115		0.629		0.419		0.51		0.755	
Feet of pipe laid with one barrel of cement	100		320		320		320		150		320	
SUMMARY OF COSTS:—												
Labor per lin. ft. of sewer	$0.497		$0.404		$0.170		$0.242		$0.792		$0.485	
Cost of pipe per lin. ft.	0.390		0.100		0.100		0.100		0.35		0.100	
Cost of sand and cement per lin. ft.	0.025		0.007		0.007		0.007		0.020		0.007	
Total cost per lin. ft.	0.912		0.511		0.277		0.349		1.162		0.592	
Contract price per lin. ft.	0.795		0.380		0.380		0.380		0.77		0.380	

	JOB XIII.		JOB XIV.		JOB XV.		JOB XVI.		JOB XVII.		JOB XVIII.	
Size of pipe, inches	8		8		8		10		8		8	
Length of pipe, feet	350		438		568		429		550		398	
Depth of trench, feet	7.2		7.7		8.0		9.5		9.0		7.3	
Width of trench, inches	28		28		28		28		24		28	
Excavation per lin. ft. of trench, cu. yds.	0.622		0.665		0.6913		0.821		0.666		0.6308	
TRENCHING:—	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.
Top men, common	12	0.03429	40	0.09132	185	0.32570	177	0.41259	181	0.32909	63	0.15829
Top men, convict	15	0.04286	21	0.04794	....	....	....	....	....	....	5	0.01256
Bottom men, common	49	0.14	218	0.49772	710	1.24999	648	1.51048	858	1.56	283	0.71105
Bottom men, convict	418	1.19428	397	0.90639	....	....	....	....	....	....	196	0.49246
Bailing	3	0.00857	....	....	12	0.02113	10	0.02331	....	....	4	0.01006
Bracing	....	....	....	....	2	0.00352	....	....	10	0.01818	....	....
Scaffolding	....	....	....	....	9	0.01585	....	....	....	....	....	....
Total labor trenching	497	1.42000	676	1.54337	918	1.61619	835	1.94638	1049	1.90727	551	1.38442
PIPELAYING:—												
Pipe layer	9	0.02571	25	0.05708	28	0.04929	33	0.07692	35	0.06363	16	0.04020
Pipe layer's helper	27	0.07714	40	0.09132	70	0.12324	37	0.08625	55	0.10	46	0.11558
Total labor pipe laying	36	0.10285	65	0.14840	98	0.17253	70	0.16317	90	0.16363	62	0.15578
BACKFILLING:—												
Team and one man	....	....	....	....	20	0.03521	22	0.05128	32	0.05818	9	0.02261
Teamster's helpers	....	....	....	....	40	0.07042	44	0.10256	61	0.11091	18	0.04523
By hand	171	0.48857	173	0.39498	142	0.25000	63	0.14685	57	0.10363	64	0.16080
Total labor back filling	171	0.48857	173	0.39498	202	0.35563	129	0.30069	150	0.27272	91	0.22864
DRAYAGE:—												
Man and team	4	0.01143	2	0.004566	3	0.00528	5	0.01165	6	0.010909	2	0.00502
Helpers	4	0.01143	2	0.004566	3	0.00528	5	0.01165	12	0.021818	2	0.00502
Total labor drayage	8	0.02286	4	0.009132	6	0.01056	10	0.02331	18	0.032727	4	0.01005
GENERAL SERVICE:—												
Foreman	8	0.02286	18	0.04110	70	0.12324	54	0.12587	70	0.12727	31	0.07789
Water boy	3	0.00857	6	0.01370	72	0.12676	50	0.11655	59	0.10727	26	0.06533
Clearing right of way	....	....	....	....	25	0.04401	....	....	....	....	....	....
Total labor general service	11	0.03143	24	0.05480	167	0.29401	104	0.24242	129	0.23454	57	0.14322
Grand total labor	723	2.06571	942	2.15068	1391	2.44892	1148	2.67597	1148	2.67597	765	1.92211
Labor hours per cu. yd., trenching	2.28		2.321		2.338		2.371		2.863		2.194	
Labor hours per cu. yd., back filling	0.785		0.594		0.513		0.3662		0.4095		0.362	
Feet of pipe laid with one barrel of cement	320		320		320		175		320		320	
SUMMARY OF COSTS:—												
Labor per lin. ft. of sewer	$0.305		$0.317		$0.344		$0.316		$0.433		$0.275	
Cost of pipe per lin. ft.	0.100		0.100		0.100		0.150		0.100		0.100	
Cost of sand and cement per lin. ft.	0.010		0.010		0.007		0.015		0.007		0.010	
Total cost per lin. ft.	0.415		0.425		0.451		0.541		0.540		0.385	
Contract price per lin. ft.	0.380		0.380		0.380		0.385		0.380		0.380	

Job 7. All hard bluish clay. Some water in bottom. Job 8. Mostly yellow clay, dry and hard. Job 9. Mostly greyish clay, dry and hard. Job 10. Mostly yellowish clay, hard, and some water in bottom. Job 11. 6 Ry. tracks. Mostly bluish mottled clay, dry and hard; no tunnelling. Job 12. 1 ft. of quicksand in bottom—very wet—steep grade. Top yellow clay, 150 ft. had dry bottom. Job 13. 200 ft. dry, hard yellow clay; 150 ft. made dirt and some water. Job 14. Dry, hard yellow sandy clay. Job 15. 1 Ry. track. Top 1 ft., saw dust filling, below sticky bog clay. Cut through old sawmill foundation. Job 16. Soft, damp bog clay. Job 17. 200 ft. same as above. Rest 4 ft. yellow clay on top very hard. Bottom hard, stiff, blue marl, caves badly when wet. Job 18. 150 ft. hard, yellow clay. Rest soft earth and sand and some water.

	JOB XIX		JOB XX		JOB XXI.		JOB XXII.		JOB XXIII.		JOB XXIV.	
Size of pipe, inches	8		8		8		8		8		8	
Length of pipe, feet	396		413		413		400		670		320	
Depth of trench, feet	7.7		10.9		8.6		9.1		7.0		6.7	
Width of trench, inches	28		28		26		26		24		20	
Excavation per lin. ft. of trench, cu. yds.	0.65		0.92		0.7		0.728		0.563		.536	
TRENCHING:—	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.
Top men, common	43	0.1080	112	0.2711	58	0.1404	74	0.1850	85	0.1268	47	0 1469
Top men, convict	....	....	7	0.1169	3	0.0072	8	0.200	....	....	....	....
Bottom men, common	138	0.3484	658	1.5932	222	0.5375	517	1.2925	552	0.8239	258	0.8062
Bottom men, convict	347	0.3470	308	0 7457	371	0 8983	177	0 4425	....	....	....	....
Bailing	2	0.0051	....	.....	2	0.0048	....	....	25	0.373	5	0 0156
Bracing	....	....	....	....	....	....	....	....	18	0.0269	2	0.0062
Scaffolding	....	....	....	....	....	....	....	....	....	....	....	....
Total labor trenching	530	0.8081	1085	2.6270	656	1 5882	776	1.9390	680	1.0149	312	0.9749
PIPELAYING:—												
Pipe layer	16	0.0404	23	0.0556	18	0 0435	26	0.0650	31	0.0462	8	0.0250
Pipe layer's helper	38	0.0959	26	0 0629	36	0.0870	34	0.0850	66	0 0988	23	0.0719
Total labor pipe laying	54	0.1363	49	0 1185	54	0.1205	60	0.1500	97	0.1450	31	0.0969
BACKFILLING:—												
Team and one man	19	0 0479	31	0 0751	14	0.0339	20	0.0500	13	0.0194	7	0.0219
Teamster's helpers	30	0 0757	26	0.0629	28	0.0678	40	0.1000	26	0.0388	14	0.0438
By hand	33	0.0833	69	0.1426	24	0.0581	22	0.1500	104	0.1104	27	0.0843
Total labor backfilling	82	0.2069	126	0 2806	66	0.1598	82	0.3000	143	0.1686	48	0.1500
DRAYAGE:—												
Man and team	3	0.0076	3	0.0072	3	0.0072	4	0.0100	13	0.0193	6	0.0187
Helpers	3	0.0076	3	0.0072	3	0.0072	7	0.0175	16	0.0239	6	0.0187
Total labor drayage	6	0.0152	6	0.0144	6	0.0144	11	0.0275	29	0.0432	12	0.0374
GENERAL SERVICE:—												
Foreman	24	0.0606	51	0.1235	17	0.0411	40	0.1000	44	0.657	8	0.0250
Water boy	33	0.0833	51	0.1235	17	0.0411	26	0.0650	44	0.0657	8	0.0250
Clearing right of way	....	....	....	....	....	....	....	....	....	....	....	....
Total labor general service	57	0.1439	102	0.2470	34	0.0822	66	0.1650	88	0.1314	16	0 0500
Grand total labor	729	1.1104	1368	3 2875	818	1.9651	995	2.4315	1037	1.5031	419	1.3092
Labor hours per cu. yd., trenching	1.2432		2.8554		2.2688		2.6561		1.8123		1.8053	
Labor hours per cu. yd., backfilling	0.3184		0.3050		0.2283		0.4109		0.3011		0.2777	
Feet of pipe laid with one barrel of cement	320		320		320		320		320		320	
SUMMARY OF COSTS:—												
Labor per lin. ft. of sewer	$0.280		$0.487		$0.291		$0.360		$0.223		$0.181	
Cost of pipe per lin. ft	0.100		0 100		0.100		0.100		0.100		0.100	
Cost of sand and cement per lin. ft	0.010		0.010		0.010		0.010		0.010		0.010	
Total cost per lin. ft	0.390		0.597		0 407		0.470		0.333		0.291	
Contract price per lin. ft	0.380		0 380		0.380		0.380		0.380		0.380	

	JOB XXV.		JOB XXVI.		JOB XXVII.		JOB XXVIII.		JOB XXIX.		JOB XXX.	
Size of pipe, inches	8		12		12		8		10		10	
Length of pipe, feet	250		305		337		160		322		311	
Depth of trench, feet	6.3		9 4		8.9		6.7		9.8		10.1	
Width of trench, inches	26		28		28		26		28		28	
Excavation per lin. ft. of trench, cu. yds	0.506		0 81		0.76		0.53		0.8		0 87	
TRENCHING:—	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.
Top men, common	77	0.3080	79	0.2557	144	0 4273	24	0.1500	97	0.3012	231	0.7427
Top men, convict	....	....	....	....	....	....	....	....	....	....	....	....
Bottom men, common	209	0.8360	442	1.4491	465	1.3798	172	1.0750	487	1.5124	577	1.8553
Bottom men, convict	....	....	....	....	....	....	...	....	....	....	....	....
Bailing	6	0 0240	19	0.0623	8	0.0237	....	......	10	0 0311	76	0.2443
Bracing	....	....	12	0.0393	8	0.0237	....	....	2	0.0062	45	0.1447
Scaffolding	....	....	....	....	....	....	....	....	...	....	....	....
Total labor trenching	292	1.1680	552	1.8064	625	1.8545	196	1.2250	596	1.8509	929	2.9870
PIPELAYING:—												
Pipe layer	12	0.0580	14	0.0459	21	0.0623	6	0 0375	16	0.0497	43	0.7427
Pipe layer's helper	22	0.0880	39	0.1278	52	0.1543	9	0.0562	39	0.1211	64	0.2058
Total labor pipe laying	33	0.1460	53	0.1737	73	0.2166	15	0 0937	55	0 1708	107	0.9485
BACKFILLING:—												
Team and one man	8	0.0320	14	0.0459	15	0.0474	4	0.0250	18	0.0559	9	0.0289
Teamster's helpers	16	0.0640	28	0.0918	30	0.0948	8	0 0500	36	0.1118	18	0.0578
By hand	30	0.1200	22	0.0721	38	0.1127	17	1.1062	42	0.1304	183	0.5884
Total labor backfilling	54	0.2160	64	0.2098	83	0.2549	29	0.1812	96	0.2981	210	0.6751
DRAYAGE:—												
Man and team	....	....	2	0.0065	....	....	....	....	4	0.0124	12	0.0386
Helpers	3	0.0120	4	0.0130	10	0.0296	4	0.0250	4	0.0124	12	0.0386
Total labor drayage	3	0.0120	6	0.0195	10	0 0296	4	0.0250	8	0.0248	24	0.0772
GENERAL SERVICE:—												
Foreman	11	0.0550	37	0.1213	32	0.0949	6	0.0375	22	0.0683	61	0.1961
Water boy	11	0.0550	35	0.1144	28	0.0831	6	0.0375	20	0.0621	48	0.1543
Clearing right of way	...	....	....	....	....	....	....	....	....	....	...	....
Total labor general service	22	0.1100	72	0.2357	60	0.1780	12	0.0750	42	0.1304	109	0.3504
Grand total labor	440	1.6520	747	2.4451	851	2.5336	256	1.5999	797	2.4550	1379	5.0382
Labor hours per cu. yd., trenching	2.3360		2.2301		2.4401		2.3113		2.3136		3.4333	
Labor hours per cu. yd., backfilling	0.4320		0 2622		0.3357		0.3419		0.3762		0.7760	
Feet of pipe laid with one barrel of cement	320		175		175		320		175		175	
SUMMARY OF COSTS:—												
Labor per lin. ft. of sewer	$0.272		$0.343		$0.353		$0.215		$0.344		$0.616	
Cost of pipe per lin. ft	0.100		0.190		0.190		0.100		0.150		0.150	
Cost of sand and cement per lin. ft	0.010		0.018		0.018		0.010		0.015		0.015	
Total cost per lin. ft	0.382		0 550		0.561		0.825		0.509		0.781	
Contract price per lin. ft	0.380		0.515		0.515		0.380		0.385		0.385	

Job 19. 3 ft. hard clay on top. Bottom hard and sandy. Water for 100 ft. in bottom. Job 20. Hard, yellow clay on top. Bottom very hard dry sand. Job 21. Mostly soft, yellow clay. Wet from leaky water pipe. 100 ft. hard, red sand bottom. Job 22. Hard, yellow clay and sand; dry ditch. Heavy rain while in this section. Job 23. Bog clay and sand, some quicksand; wet bottom. Job 24. Top 2 ft. filled dirt; water at top of old surface; old earth bog clay; water not serious. Job 25. Top 2 ft. filled dirt; water at top of old surface; old earth bog clay; water not serious. Job 26. Top 2 ft. filled dirt; water at top of old surface; old earth bog clay; water not serious. Job 27. Top 2 ft. filled dirt; water at top of old surface; old earth bog clay; water not serious. Job 28. Top 2 ft. filled dirt; water at top of old surface; old earth bog clay; water not serious. Job 29. Soft yellow clay on top; for 150 ft. had 5 ft. of stiff, hard, blue clay bottom. Job 30. Mostly filled material; freezing weather and top caved badly; 100 ft. very wet; cut through top of old culvert.

	JOB XXXI.		JOB XXXII.		JOB XXXIII.		JOB XXXIV.		JOB XXXV.		JOB XXXVI.	
Size of pipe, inches	8		8		8		8		8		8	
Length of pipe, feet	789		347		451		396		386		450	
Depth of trench, feet	6.6		7.6		9.3		9.3		8.9		7.7	
Width of trench, inches	28		26		24		28		26		26	
Excavation per lin. ft. of trench, cu. yds.	0.57		0.61		0.688		0.804		0.714		0.618	
TRENCHING:—	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.
Top men, common	124	0.15716	59	0.17003	79	0.17517	116	0.29293	68	0.17440	33	0.07333
Top men, convict	....	....	....	....	....	....	....	....	....	....	....	....
Bottom men, common	820	1.03927	398	1.14695	631	1.39911	525	1.32576	515	1.32083	527	1.17111
Bottom men, convict	....	....	....	....	....	....	....	....	....	....	....	....
Bailing	83	0.10519	18	0.05187	26	0.05765	26	0.06565	11	0.02821	16	0.03556
Bracing	15	0.01901	....	....	....	....	27	0.06818	....	....	....	....
Scaffolding	....	....	....	....	....	....	....	....	....	....	....	....
Total labor trenching	1042	1.32063	475	1.36885	736	1.63193	694	1.75252	594	1.52344	576	1.28000
PIPELAYING:—												
Pipe layer	57	0.07224	27	0.07781	21	0.04656	31	0.07828	13	0.03334	16	0.03556
Pipe layer's helper	88	0.11153	50	0.14409	55	0.12195	52	0.13131	39	0.10002	43	0.09555
Total labor pipe laying	145	0.18377	77	0.22190	76	0.16851	83	0.20959	52	0.13336	50	0.13111
BACKFILLING:—												
Team and one man	15	0.01901	17	0.04899	19	0.04213	14	0.03535	17	0.04360	14	0.03111
Teamster's helpers	30	0.03802	34	0.09798	38	0.08426	28	0.07071	34	0.08720	28	0.06222
By hand	96	0.12167	40	0.11527	37	0.08204	38	0.09596	43	0.11028	25	0.05556
Total labor backfilling	141	0.17870	91	0.26224	94	0.20843	80	0.20202	94	0.24108	67	0.14889
DRAYAGE:—												
Man and team	16	0.02028	6	0.01729	6	0.01330	9	0.02273	8	0.02052	7	0.01555
Helpers	18	0.02281	6	0.01729	6	0.01330	7	0.01767	1	0.00256	3	0.00667
Total labor drayage	34	0.04309	12	0.03458	12	0.02660	16	0.04040	9	0.02308	10	0.02222
GENERAL SERVICE:—												
Foreman	57	0.07224	10	0.02882	34	0.07539	26	0.06565	14	0.03590	17	0.03778
Water boy	56	0.07097	10	0.02882	32	0.07095	26	0.06565	14	0.03590	17	0.03777
Clearing right of way	....	....	....	....	....	....	....	....	....	....	....	....
Total labor general service	113	0.14321	20	0.05764	66	0.14634	52	0.13130	28	0.07180	34	0.07555
Grand total labor	1475	1.8694	675	1.94521	984	2.18181	925	2.33584	777	1.99276	746	1.65777
Labor hours per cu. yd., trenching	2.317		2.244		2.37		2.18		2.133		2.07	
Labor hours per cu. yd., backfilling	0.3135		0.43		0.303		0.251		0.338		0.241	
Feet of pipe laid with one barrel of cement	320		320		320		320		320		320	
SUMMARY OF COSTS:—												
Labor per lin. ft. of sewer	$0.260		$0.245		$0.301		$0.326		$0.279		$0.265	
Cost of pipe per lin. ft.	0.100		0.100		0.100		0.100		0.100		0.100	
Cost of sand and cement per lin. ft.	0.010		0.010		0.010		0.010		0.010		0.010	
Total cost per lin. ft.	0.370		0.355		0.411		0.436		0.389		0.375	
Contract price per lin. ft.	0.380		0.380		0.380		0.380		0.380		0.380	

	JOB XXXVII.		JOB XXXVIII.		JOB XXXIX.		JOB XL.		JOB XLI.		JOB XLII.	
Size of pipe, inches	10		8		8		8		8		8	
Length of pipe, feet	391		430		325		330		300		370	
Depth of trench, feet	9.6		7.0		8.9		8.5		8.5		6.3	
Width of trench, inches	30		26		26		26		26		26	
Excavation per lin. ft. of trench, cu. yds.	0.88		0.55		0.71		0.68		0.68		0.505	
TRENCHING:—	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.	Total hours.	Hours per lin. ft.
Top men, common	160	0.4092	117	0.2721	75	0.2307	43	0.1303,	21	0.0700	28	0.0757
Top men, convict	....	....	....	....	....	....	....	....	....	....	....	....
Bottom men, common	657	1.6803	411	0.9558	471	1.4492	401	1.2151	380	1.2666	273	0.7378
Bottom men, convict	....	....	....	....	....	....	....	....	....	....	....	....
Bailing	91	0.2327	....	....	13	0.0400	28	0.0848	14	0.0466	4	0.0108
Bracing	129	0.3299	63	0.1465	21	0.646	6	0.0181	2	0.0066	....	....
Scaffolding	34	0.0869	....	....	....	....	....	....	....	....	....	....
Total labor trenching	1071	2.7390	591	1.3744	580	1.7845	478	1.4483	417	1.3898	305	0.8243
PIPELAYING:—												
Pipe layer	23	0.0588	36	0.0837	13	0.0400	19	0.0576	12	0.0400	11	0.0297
Pipe layer's helper	69	0.1764	77	0.1791	37	0.1138	41	0.1242	30	1.1000	35	0.0946
Total labor pipe laying	92	0.2352	113	0.2628	50	0.1538	60	0.1818	42	0.1400	46	0.1243
BACKFILLING:—												
Team and one man	22	0.0585	....	....	14	0.0431	13	0.0393	9	0.0300	....	....
Teamster's helpers	44	0.1170	....	....	28	0.0862	26	0.0786	18	0.0600	....	....
By hand	71	0.1816	124	0.2883	23	0.0707	24	0.0724	35	0.1166	72	0.1946
Total labor backfilling	137	0.3571	124	0.2883	65	0.2000	63	0.1903	62	0.2066	72	0.1946
DRAYAGE:—												
Man and team	11	0.0284	9	0.0209	11	0.0338	7	0.0212	4	0.0133	3	0.0081
Helpers	8	0.0204	....	....	8	0.0246	12	0.0362	4	0.0133	3	0.0081
Total labor drayage	19	0.0488	9	0.0209	19	0.0584	19	0.0574	8	0.0266	6	0.0162
GENERAL SERVICE:—												
Foreman	59	0.1253	15	0.0349	36	0.1107	28	0.0848	29	0.0966	20	0.0541
Water boy	43	0.1099	16	0.0372	7	0.0215	8	0.0242	15	0.0500	....	....
Clearing right of way	....	....	....	....	....	....	....	....	....	....	....	....
Total labor general service	102	0.2352	31	0.0711	43	0.1323	36	0.1090	44	0.1466	20	0.0541
Grand total labor	1421	3.6153	858	2.0175	757	2.3290	656	1.9868	573	1.9096	449	1.2135
Labor hours per cu. yd., trenching	3.1124		2.4990		2.5133		2.1300		2.0438		1.6586	
Labor hours per cu. yd., backfilling	0.4058		0.5241		0.2816		0.2798		0.3038		0.3892	
Feet of pipe laid with one barrel of cement	175		320		250		250		250		250	
SUMMARY OF COSTS:—												
Labor per lin. ft. of sewer	$0.524		$0.292		$0.360		$0.304		$0.294		$0.180	
Cost of pipe per lin. ft.	0.150		0.100		0.100		0.100		0.100		0.100	
Cost of sand and cement per lin. ft.	0.015		0.010		0.010		0.010		0.010		0.010	
Total cost per lin. ft.	0.689		0.402		0.480		0.414		0.404		0.290	
Contract price per lin. ft.	0.385		0.380		0.380		0.380		0.380		0.380	

Job 31. 200 ft. heavy, wet clay; lots of water; 400 ft. sand and clay wet; 200 ft. with clay top and 2 ft. hard clay bottom, dry. Job 32. 100 ft. yellow clay and wet bottom, 50 ft. of caving banks; 200 ft. hard, red sand, bottom wet. Job 33. Hard, yellow sandy clay top and hard, red sand bottom; some water in bottom. Job 34. Hard, yellow sandy clay top and hard, red sand bottom; some water in bottom. Job 35. Hard, yellow sandy top and hard, red sand bottom; some water in bottom. Job 36. Hard, yellow sandy clay top and hard, red sand bottom; some water in bottom. Job 37. Sand for most part and lots of water; 100 ft. tight sheeted. Job 38. Wet, sandy, some quicksand. Job 39. Bluish joint clay top; sandy bottom, wet. Job 40. 150 ft. red sand bottom, wet; 150 ft. heavy clay with 2 ft. fill on top. Job 41. Red sand, hard wet bottom. Job 42. Easy digging, sand soil, dry.

Specifications for Constructing Petrolithic Pavement with Tamping Roller.

A description of the Petrolithic Rolling Tamper and its operation in constructing oiled roads was published in our issue of April 17. One of the cities mentioned as having used this device was the city of Santa Monica, Cal. In the last report of the Department of Highways of California the specifications in force at Santa Monica for this class of street work were published in full and are of sufficient interest to be reprinted. These specifications are as follows:

(1) Contractors shall use the tamping roller approved by the Superintendent of Streets and Board of Trustees of the City of Santa Monica for all work under these specifications.

(2) The streets shall be plowed to a depth of 6 in. and graded evenly with a crown to conform to the established height at center of street, and properly pulverized with said tamping roller. Said tamping roller shall be weighted from two to three tons, and to form a solid base up to 4 ins. from top.

(3) Where there is no cement or paved gutter, then the gutter 3 ft. wide out from curb shall be done in the following manner: Remove the earth 6 ins. deep below finished grade by the use of a grading machine, leaving earth so removed in the street; then loosen bottom lightly, apply water sufficiently; then apply 1½ gallons of oil to each square yard of surface, evenly; refill three inches of loose earth and water sufficient; tamp this evenly and solid, by using a wagon or truck with four-inch width of tires, weighted sufficiently to make a solid base; then back fill to grade. Gutters at street intersection, as indicated by plans, shall be of double width and constructed as hereinbefore mentioned.

(4) When the street is properly graded, pulverized, and tamped solid to within 4 ins. from the top, then apply water sufficient to thoroughly and evenly dampen to a proper consistency, 4 ins. deep; loosen with a cultivator lightly set so as not to disturb sub base; then the oil shall be applied as follows: The street shall be coated evenly with oil at the rate of three-fourths of the amount to be used; then plow the oil under 4 ins. deep with a gang plow, commencing at center of street; then harrow diagonally two ways, and then tamp with tamping roller weighted to penetrate 4 ins. evenly and solid to within 1½ ins. of the top; then run a road grader or scarifier over entire surface lightly, to make the street an even grade; then harrow and apply sufficient water; then apply the second coat of one-fourth of the amount of oil to be used, evenly spread over entire surface of street; then harrow and tamp with tamping roller evenly and solid to top; then tamp gutters eighteen inches wide out from curb with a wagon or truck weighted with four tons, as hereinbefore specified. The work and material under this section to be done the full width of the street and over the oil base of gutters as specified in Section III of these specifications.

(*f*) *Water and Sediment.* All crude petroleum shall be tested for water and sediment.

(*g*) *Test for Water and Sediment.* The "gasoline test" shall be used to determine the amount of water and sediment. Said test shall consist of equal parts of crude petroleum and 68° Baume gasoline, mixed in a glass-stoppered glass cylinder and left to stand twenty-four hours; thereupon reading shall be taken and the percentage of water and sediment determined.

(*h*) *Deductions.* Deductions for water and sediment in crude petroleum will be made in exact proportion to the percentage of such water and sediment found. Deductions for shortage in volume will be made in the exact number of gallons tank wagons are found to be short on delivery.

(*i*) *Tank Wagons.* All tank wagons used for delivering the crude petroleum must first be submitted to the street superintendent, who shall gauge and stamp into the steel head of said tanks the capacity in gallons said tanks will contain, and no figures of capacity will be accepted other than the official rating given by the street superintendent.

(*j*) All oil to be used shall be tested by an oil inspector employed by the street superintendent for that purpose.

(*k*) Oil shall be tested at tanks before delivery upon work, and if same shall not comply with specifications, it shall not be delivered at the work.

5. CULVERTS.

Culverts shall be plased wherever designated on the profiles or plans of the street on file in the office of the City Examiner. They shall be of the character and dimensions shown in the profile or plan and described in the specifications named in the ordinance of intention.

Wherever, upon any street or alley, any cement crosswalks, cement gutters, or any paving and machine work are impracticable, then the same shall be done in same manner by hand work under the direction of the superintendent of streets.

The contractor will be held responsible for all damages to curbs, gutters, crosswalks, flumes, etc., that may be caused by him in the performance of the work. When water or oil is to be applied the condition of the soil shall be subject to the approval of the superintendent of streets. The contractor shall be required to examine all plans for the above work on file in the office of the City Engineer.

(5) The quantity of crude oil to be applied to be 2½ gallons for every square yard of surface of heavy soil, and three gallons for every square yard of light sandy soil, unless otherwise specified, from curb to curb, where there is no gutter, and where there are cement or paved gutters, then from gutter to gutter, and at all intersections of streets and alleys to property line on both sides.

(6) The oil shall be from 12° to 14° gravity, Baume test, at a temperature of 60° Fahrenheit, and contain from 40 per cent to 60 per cent of "D" grade asphalt, to be subject to the gasoline test for water and foreign matter, and not to contain over 2 per cent of water or foreign matter, and heated to a temperature sufficient to run freely from a sprinkler or tank; provided, however, that in dry or dusty soil 20 gallons of water must be used every nine square feet or road surface before applying the oil. The contractor shall provide an analysis of oil furnished when called for by the street superintendent.

(7) To insure the quality and quantity of all oil used under these specifications, the contractor shall deliver said oil into the city's tanks at the corporation yard, there to be tested for gravity, water, and foreign substance, by the street superintendent or his assistant, whose duty it shall be, after said tests are made, to heat, measure and deliver said oil into such tank wagons as may be used to deliver and spread the oil on the street; and oil so handled at city tanks shall be subject to a charge of ——— cents per barrel, said charge to be paid by the contractor to the City of Santa Monica. A complete record of all these transactions shall be kept by the street superintendent.

(8) The contractor shall erect a fence and keep a proper barrier along the line of said work and across the ends of same both day and night, and to maintain red lights between sunset and sunrise, and post all legal notices and signals as to the state of the roadway or street during the prosecution of the work.

Reference is hereby made to the general specifications now in force for the grading of streets within the City of Santa Monica, including all ordinances, etc.

(9) The work shall be performed under the supervision of the City Engineer and street superintendent. Also subject to the approval of the Board of Trustees of the City of Santa Monica, or their authorized agents.

A new agreement for the building of a railway between Tientsin and Chinkiang has been reached which will provide that a British syndicate shall build the southern half of the line with its own funds, while a German syndicate will do the same for the northern half. A certain period will be allowed the foreign syndicates to run the line, after which it shall be allowable for the Chinese to redeem the railway.

Itemized Cost of Two Telephone Lines.

In our issue of July 10 the itemized cost of a telegraph line was given. Similar data for telephone construction are given herewith. Two short lines were built, one 10 miles long and the other 14 miles long. The cost of the 10 mile line was as follows per mile:

Labor:	
1.7 days foreman at $4.00	$ 6.80
1.7 days sub-foreman at $3.00	5.10
4.0 days climbers at $2.50	10.00
10.5 days groundmen at $2.25	23.63
17.9 days total at $3.10	$55.53
Materials:	
28 poles at $1.50	$ 42.00
28 cross arms at $0.15	4.20
28 steel pins at 0.04	1.12
28 glass insulators at 0.04	1.12
56 lag screws and washers at 0.015	0.84
305 lbs. No. 9 galv. wire at 0.042	12.81
Total materials	$62.09
Total labor and materials	$117.62

More than 90 per cent of the poles were 25 ft. long. The rest were 30 to 40 ft. in length.

The cost of the 14 mile line was as follows per mile:

Labor:	
2.2 days foreman at $3.50	$ 7.70
2.2 days sub-foreman at $3.00	6.60
5.3 days climber at $2.75	14.58
11.4 days groundman at $2.25	25.64
21.5 days total at $2.54	$54.52
Materials:	
32 poles at $1.50	$48.00
32 brackets at 0.015	0.48
380 lbs. No. 8 galv. wire, 0.042	15.96
10 lbs. No. 9 galv. wire, 0.042	0.42
1½ lbs. fence staples, 0.025	0.04
32 insulators, 0.04	1.28
Total materials	$66.18
Total labor and materials	$120.70
2 telephones at $12.50	$ 25.00
200 ft. office wire	$ 1.40

Considering the low cost of telephone lines of this character, it is surprising that they are not more frequently built for use on construction work. For temporary purposes, a much cheaper kind of poles could be used. For example, a very substantial pole could be made by nailing together two 1x4-in. boards, so as to form a post having a T-shape cross-section. Such a pole would contain only two-thirds of a foot, board measure (2-3 ft. B. M.) per lineal foot of pole. At $24 per M for the boards, a pole 20 ft. long would cost 32 cts.

Hence the poles would cost less than $10 per mile of line. The No. 9 wire would ordinarily cost less than $13 per mile, and $3 more would cover the cost of the remaining line materials, making a total cost of $26 per mile for materials. We have no data as to the labor of erecting such a line, but it would certainly be less than $15 per mile; and in soil where post hole diggers could be used, the cost would be considerably less. In fact, a telephone line built for $35 a mile might easily be obtained under fairly favorable conditions. Moreover it could be taken down and used many times on subsequent construction.

LETTERS TO THE EDITORS.

The Best Way to Construct Concrete Curb and Gutter.

Sirs: What is the best way to construct concrete curb and gutter? Should the curb wall and gutter slab be built in one piece or should they be built separately—in two pieces—and if built in two pieces where should the plane of separation be made? The writer can perhaps best make his question clear by means of a sketch; this sketch, by the way, represents actual examples of curb and gutter work as described in recent issues of Engineering-Contracting. Figure 1 shows a one-piece or monolithic curb and gutter; Fig. 2 shows a two-piece curb and gutter in which the curb wall is built first and the gutter slab butted against it with the structural joint at a-b; and Fig. 3 shows a two-piece construction in which the gutter slab is built first and the curb wall set on it with the structural joint at c-d. The three figures show three different methods of construction. What are the advantages and disadvantages of each and which is the best and why is it best? The writer has his own opinions in the matter, but never having built any concrete curb and gutter would be glad to learn from those who possess that experience. The first question to be answered would seem to be whether a one-piece structure like that shown in Fig. 1 or a two-piece structure like that shown in either Fig. 2 or Fig. 3 is generally the most efficient for its purpose, keeping in mind ease and cost of construction as well as solidity and durability. The second question is, naturally, which of the two-piece structures, Figs. 2 and 3, is generally the most efficient when similarly compared? If any of the many engineer and contractor readers of Engineering-Contracting can elucidate these questions the writer for one will be greatly indebted to him.

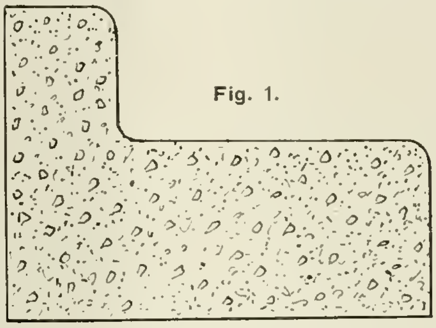


Fig. 1.

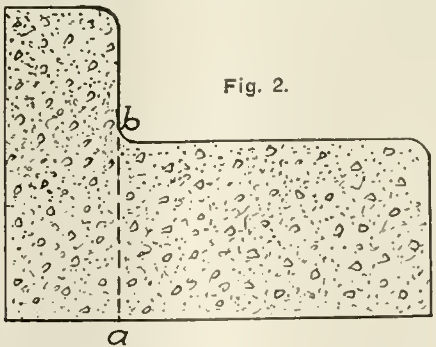


Fig. 2.

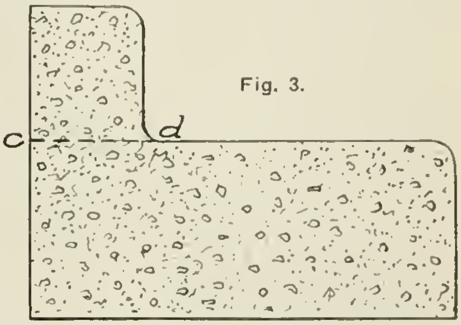


Fig. 3.

Very truly, "Engineer."

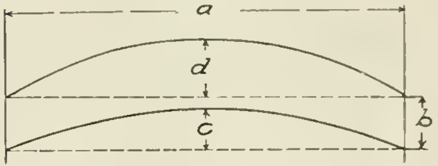
Chicago, Ill., July 10, 1907.

(We shall be glad to receive and publish any communications on the subjects suggested by our correspondent.—Editors.)

How to Compute the Cross-Section of a Curved Street Paving.

Sirs: Referring to an article on above subject in your issue of June 12th, 1907, I beg to offer the following as a simple and practical method.

The formula is based on the principle that the area within a parabolic curve is two-thirds of the area of a rectangle of which one side is the chord and the other the rise of the parabola.



Referring to the accompanying figure, the desired area between the curves and the end verticals is evidently the area of the rectangle ab, plus the area within the upper curve and minus the area within the lower curve; or

$$\text{area} = ab + \frac{2}{3}\,ad - \frac{2}{3}\,ac$$

whence $\text{area} = \frac{a}{3}\,[3b + 2(d - c)].$

Giving a, b, c and d the values used in the example in your article, we have:

$\text{area} = \frac{27}{3}\,[3 \times 1.125 + 2(1 - .583)] =$ 37.881 sq. ft.

Your formula gives 37.07 sq. ft. or about one-half of one per cent more, probably due to the use of circular curves.

For flat curves as in this case the circle and parabola coincide closely, while the latter is much more convenient for laying out vertical curves in the field. Respectfully,

Henry A. La Chicotte.

21 Park Row, New York, June 26, 1907.

Engineers' Pocketbook of Reinforced Concrete.*

BY E. LEE HEIDENREICH, C. E., M. E.

(Continued from Engineering-Contracting, July 10, 1907.)

Example of Building Designed According to the Foregoing Principles.—In order to illustrate the use of the tables given under Building Design, and to further illustrate the principles underlying the design of raft foundations, the following example is given.

It is required to design a warehouse, 60 by 60 ft. square, 6 stories in height, with basement. In the southeast corner, above the roof, is a garner, weighing with contents, 200,000 lbs. The live load on floors is 182 lbs. per sq. ft., and on the roof, the live load is 78 lbs. per sq. ft. The property on the north is not occupied, but must not be encroached upon. On the east stands a heavy warehouse without basement, hence its foundations are comparatively shallow so that the basement of the new building is 2 ft. below the bottom of foundations of this property. Soil is stratified, sustaining a pressure of 5,000 lbs. per sq. ft. Time prevents the driving of piling, which also would endanger the adjoining building.

A reinforced concrete mat and raft foundation is decided upon.

The Calculations, based upon a 1:6 mixture of Portland cement, sand and crushed stone passing a ¾-in. ring, are as follows, for the 1st to 6th floors inclusive, assuming that beams are spaced 7 ft. 6 ins. on centers, and that girders are spaced 15 ft. on centers:

Slabs.—Assuming a span of 7 ft., and a dead load of 64 lbs. per sq. ft.,

$$182 + 64 = 246 \text{ lbs. per sq. ft.}$$

Referring to table p. 80,† and taking

$$p = 0.006 \text{ and } C = 580, \ h = 5 \text{ ins.}$$

The steel area per foot is .288 sq. ins., from same table.

Assuming ½-in. rods as reinforcement, by table p. 58‡ their area is seen to be 0.196 sq. ins. The spacing accordingly is

$$\frac{0.196}{0.288} \times 12 = 8\tfrac{1}{4} \text{ ins. on centers,}$$

where no fabric is used.

Beams.—We approximate

W = 8 × 246 = 1,968 lbs. per ft. of beam, including the weight of the beam, and assuming a beam 12 ins. wide.

For 1 in. width of beam,

$$w = \frac{1968}{12} = 164 \text{ lbs.}$$

Table p. 78, for span of 15 ft., gives a depth of 26 ins. for a load of 177 lbs. For 164 lbs. the depth is 25 ins., giving a beam 12x25 ins., or 12x20 ins. below the slab

The same table gives steel area for 1 in. width between 0.199 and 0.182; assuming 0.190 sq. ins.,

$$0.190 \times 12 = 2.28 \text{ sq. ins.}$$

Assuming 8 rods,

$$228 \div 8 = .285 \text{ sq. ins.,}$$

which corresponds to a diameter of ⅝ ins.

Later will be shown that two extra rods are laid in such beams as support the columns on a cantilever. All rods are to be carefully fastened in a frame before being placed.

Girders.—

$$1{,}968 \times 15 = 29{,}520 \text{ lbs. concentrated load.}$$

$$\text{Hence } M = \frac{29{,}520 \times 15}{4} \times 12 = 1{,}328{,}400 \text{ in. lbs.}$$

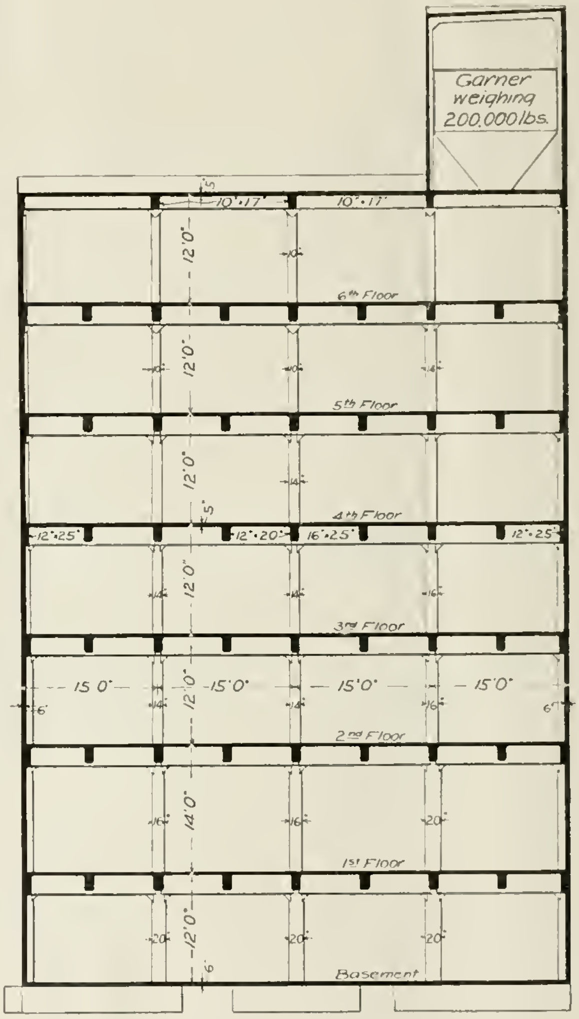
Selecting a width of 16 ins., the moment for 1 in. width becomes

$$M = \frac{1{,}328{,}400}{16} = 83{,}025 \text{ in lbs.}$$

In table p. 79, we interpolate between a 36-in. depth at 116,700 in. lbs., and a 30-in. depth at 81,540, and find a depth of 30.3 ins. for 83,025 in. lbs., leaving the girder practically 16x25 ins. below the slab.

The same table gives the steel area, by interpolating between 0.278 and 0.232, at 0.234 sq. ins.

$$16 \times 0.234 = 3.744 \text{ sq. ins.}$$



Section Through Building.

Assuming 8 rods, and consulting table p. 58,

$$\frac{3.744}{8} = .468 \text{ sq. in.}$$

or 8 rods, ¾ in. in diameter.

Eight ¾-in. rods are accepted, as no attention has been paid to the fact that the girder is continuous.

Location of Stirrups for Beams.—The net span of the beam is seen to be 13 ft. 8 ins., the depth being 25 ins. Using Mr. Ransome's empirical rule for spacing stirrups, (see page 74*) they would be located 6¼ ins., 12½ ins., 18¾ ins., and

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*Copyrighted, 1907, by the Myron C. Clark Publishing Co.

†Reprint of pages 78 to 83, Engineers' Pocketbook of Reinforced Concrete is given on pages 67 and 68 of this issue.

‡Table referred to as being on page 58 is a table giving diameter and area of circles, not reprinted.

*Mr. E. L. Ransome's empirical rule for spacing stirrups is to place the first a distance from the end of a beam corresponding to one-quarter the depth of the beam, the second a distance of one-half the depth of the beam, beyond the first, the third a distance of three-quarters the depth of the beam beyond the second and the fourth a distance of the depth of the beam beyond the third. Having found this rule very simple, practical and corresponding with calculations, the author generally employs the same.

25 ins. apart, from the end of the beam. This leaves a space of 39½ ins. in the center of the span, which is too great. To eliminate this, the spacing adopted is 6 ins., 14 ins., 20 ins., and 26 ins., thus making the central space 32 ins., and employing 8 stirrups, the material used for same being ½-in. square bars.

Stirrups for Girders are calculated and located in the same manner as for beams.

Wall Girders.—The load is one-half the regular girder load, or 14,760 lbs., plus the weight of the curtain wall between pilasters, which is 13,500 lbs.

Formula for M, with uniform and concentrated load is

$$M = (\tfrac{1}{4}W_1 + \tfrac{1}{8}W_2)l = \left(\frac{14{,}760}{4} + \frac{13{,}500}{8}\right) 15 \times 12 = 967{,}950$$

in. lbs.

Assuming the same depth as for the other girders, their breadth will be

$$\frac{967{,}950}{81{,}540} = 12 \text{ ins.}$$

The steel area is ¾ that of the other girders or ¾ of 3,744 sq. ins. or 2.808 sq. ins. Choosing 6 rods,

$$2.808 \div 6 = .468 \text{ sq. ins.}$$

This corresponds to a diameter of 13-16 ins.

The stirrups and their spacing are calculated as before.

Roof Slab.—We will make the slabs continuous in both directions and omit the center beams. The live and dead load is

$$78 + 64 = 142 \text{ lbs. per sq. ft.}$$

Since a more carefully graded concrete will be used in the roof to increase its impermeability to water, the value for C can be higher, and p will be higher.

Taking $p = 0.008$, and $C = 680$,

table page 83 gives for 142 lbs. load and 15 ft. span, a depth of 5 ins., and a steel area of 0.384 sq. in., or, by table, p. 58, using ⅝-in. rods, their spacing is

$$\frac{.03068}{.0384} \times 12 = 9\tfrac{5}{8} \text{ ins. on centers.}$$

Roof Beams and Roof Girders are calculated alike. Approximately

$W = 142 \times 8.5 = 1{,}207$ lbs. per linear foot, including weight of beam.

Selecting a width of 10 ins.,

$$W = \frac{1207}{10} = 121 \text{ lbs.}$$

By table p. 78, this corresponds to a depth of 22 ins. The steel area is $10 \times .166 = 1.66$ sq. ins. Assuming 6 rods, their diameter is found, by table p. 58, to be ⅝ ins.

Columns.—We first make a column schedule as shown below, and which explains itself. For tall buildings, it is customary to deduct 5% of the live load for the top floor, 10% for the floor below, and 5% more for each floor except the first floor, until 50% of the live load has been deducted. This, however, we will omit in the example, as it amounts to very little, and might tend to complicate the problem.

(Reprinted from pages 82 and 83 of forthcoming book, Engineers' Pocketbook of Reinforced Concrete.)

Safe Loads per Sq. Ft. and Steel Area for Slabs.*

Either continuous or fixed at the 4 edges.

Safe Loads per Sq. Ft. and Steel Area for Slabs--Continued.*

Either continuous or fixed at the 4 edges.

Thickness.	Safe load per sq. ft., including weight of slab. Span in Feet.												Wt. of slab per sq. ft.	Depth to steel.	Depth below steel.	Steel area per 1 ft. width of slab.	Safe moment of resistance.	Thickness.
h ins.	4	5	6	7	8	9	10	11	12	13	14	15	lb.	d. in.	in.	sq. in.	in. lbs.	h ins
p=0.004. C=460.																		
3	325	208	144	106	81	64	52	44	36	....	......	......	38	2¼	¾	.108	3120	3
3½	486	311	216	159	122	96	78	64	54	46	......	......	45	2¾	¾	.132	4670	3½
4	679	435	302	222	170	134	109	90	75	64	......	......	51	3¼	¾	.156	6520	4
4½	787	504	350	257	197	156	126	104	87	74	64	56	58	3½	1	.160	7560	4½
5	1028	658	457	336	257	203	164	136	114	97	84	53	64	4	1	.192	9870	5
6	1606	1028	714	524	402	317	257	212	178	152	131	114	77	5	1	.240	15420	6
7	2314	1481	1028	756	579	457	370	306	257	219	189	165	90	6	1	.288	22220	7
8	3148	2015	1400	1028	787	622	504	416	350	298	257	224	103	7	1	.336	30230	8
p=0.006; C=580.																		
3	480	307	214	157	120	95	77	63	53	45	39	34	38	2¼	¾	.162	4610	3
3½	717	459	319	234	179	142	115	95	86	68	58	51	45	2¾	¾	.198	6880	3½
4	1001	641	445	327	250	198	160	132	111	95	82	71	51	3¼	¾	.234	9610	4
4½	1161	743	516	379	290	229	186	154	129	110	95	83	58	3½	1	.252	11150	4½
5	1517	971	674	495	379	300	243	200	168	144	124	108	64	4	1	.288	14560	5
6	2370	1517	1053	774	592	468	379	313	263	224	193	168	77	5	1	.360	27750	6
7	3412	2184	1517	1114	853	671	546	451	379	325	278	243	90	6	1	.432	32760	7
8	4644	2973	2065	1517	1161	918	743	614	516	440	379	330	103	7	1	.504	44590	8
p=0.008; C=680.																		
3	631	404	281	206	158	125	101	83	70	60	52	45	38	2¼	¾	.216	6060	3
3½	943	603	419	308	236	186	151	125	105	98	77	67	45	2¾	¾	.264	9050	3½
4	1317	843	585	430	320	260	211	174	146	125	107	94	51	3¼	¾	.312	12640	4
4½	1527	977	678	499	382	302	244	202	170	145	125	109	58	3½	1	.336	14660	4½
5	1955	1277	877	651	499	394	319	264	222	189	163	142	64	4	1	.384	19150	5
6	3117	1995	1386	1018	779	616	499	412	346	295	254	222	77	5	1	.480	29930	6
7	4488	2873	1995	1466	1122	887	718	594	499	425	366	319	90	6	1	.576	43090	7
8	6110	3910	2715	1995	1527	1207	978	808	518	499	434	103	103	7	1	.672	58650	8
p=0.010, C=700.																		
3	698	447	310	228	174	138	112	92	78	66	57	50	38	2¼	¾	.270	6700	3
3½	1043	667	463	340	261	206	167	138	116	99	85	74	45	3¾	¾	.330	10010	3½
4	1457	936	648	476	364	288	233	193	162	138	119	104	51	3¼	¾	.390	13990	4
4½	1690	1081	751	552	422	334	270	223	188	160	138	120	58	3½	1	.420	16220	4½
5	2206	1412	981	720	552	436	353	292	245	209	180	157	64	4	1	480	21180	5
6	3448	2206	1532	1126	862	681	552	456	383	326	281	245	77	5	1	.600	31100	6
7	4964	3177	2207	1621	1241	981	794	656	552	470	405	353	90	6	1	.720	47660	7
8	6758	4326	3004	2207	1699	1335	1081	894	751	640	552	481	103	7	1	.840	64880	8
p=0.012; C=700.																		
3	743	475	330	243	186	147	119	98	83	70	61	53	38	2¼	¾	.324	7130	3
3½	1109	710	493	362	277	219	177	147	123	105	91	79	45	2¾	¾	.396	10650	3½
4	1549	991	668	506	387	306	248	205	172	147	126	110	51	3¾	¾	.468	14870	4
4½	1797	1150	790	587	449	355	288	238	200	170	147	128	58	3½	1	.504	17250	4½
5	2347	1502	1043	766	587	464	375	310	261	222	192	167	64	4	1	.576	22530	5
6	3666	2347	1630	1197	917	724	587	485	407	347	299	261	77	5	1	720	35200	6
7	5280	3379	2347	1724	1320	1043	845	698	587	500	431	375	90	6	1	864	50690	7
8	7187	4599	3195	2347	1797	1420	1150	950	798	680	587	511	103	7		1.008	68990	8

* Proportions, 1:6; C= or < 700; f=or < 14000; E=3,000,000

* $M = \frac{wl^2 \times 12}{20}$; $M_c = \frac{1}{2} C k \left(1 - \frac{k}{3}\right) bd^2$; $M_s = pf\left(1 - \frac{k}{3}\right) bd^2$.

(Reprinted from pages 78 and 79 of forthcoming book, Engineers' Pocketbook of Reinforced Concrete.)

Safe Loads and Steel Area for Beams.

One Inch Wide.

Depth of beam. h in.	Safe Load in lbs. per linear ft. of beam. Span in feet = l. 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	25	30	35	Wt. of beam, 1 in. wide, per lin. ft. lbs.	Depth to steel d in.	Depth below steel in.	Steel area for 1 in width of beam sq in	Safe moment of resistance M	Depth of beam h in
5	44	31	22	17	14	11	9	8												5.4	4.	1	.033	1660	5
6	69	48	35	27	21	17	14	12	10	9	8									6.4	5.	1.	.041	2600	6
7	99	69	51	39	31	25	21	17	15	13	11									7.5	6.	1.	.050	3740	7
8	135	94	69	53	42	34	28	23	20	17	15	13								8.6	7	1.	.058	5100	8
9	166	115	85	65	51	41	34	29	25	21	18	16								9.6	7.75	1.25	.064	6250	9
10	212	147	108	82	65	53	44	37	31	27	23	21	18	16						10.7	8.75	1.25	.073	7960	10
11	262	182	134	102	81	65	54	46	39	33	29	26	23	20	18					11.8	9.75	1.25	.081	9890	11
12	319	222	163	125	98	80	66	55	47	41	35	31	28	25	22	20				12.8	10.75	1.25	.089	12020	12
13	365	253	186	143	112	91	75	63	54	46	41	36	32	28	25	23				13.9	11.5	1.5	.095	13750	13
14	431	300	220	168	133	108	89	75	64	55	48	42	37	33	30	27	17			15.	12.5	1.5	.104	16250	14
15	503	349	257	196	155	126	104	87	74	64	56	49	43	39	35	31	20			16.	13.5	1.5	.112	18960	15
16	580	403	296	227	179	145	120	101	86	74	64	57	50	45	40	36	23			17.1	14.5	1.5	.120	21870	16
17	663	460	338	259	204	166	137	115	98	84	74	65	57	51	46	41	26			18.1	15.5	1.5	.129	24980	17
18	751	522	383	294	232	188	155	130	111	96	83	73	65	58	52	47	30			19.2	16.5	1.5	.137	28310	18
19		554	407	312	246	199	165	138	118	102	88	78	69	61	55	50	32			20.3	17.	2.	.141	30060	19
20		621	456	349	276	223	185	155	132	114	99	87	77	69	62	56	36	25		21.4	18	2	.149	33690	20
22			563	432	341	276	228	193	163	141	123	108	95	85	76	69	44	31		23.6	20.	2.	.166	41600	22
24			681	522	412	334	276	232	197	170	148	130	115	103	92	83	53	37		25.7	22	2	.182	50340	24
26				621	490	397	329	276	235	203	177	155	137	123	110	99	64	44		27.9	24	2.	.199	59900	26
28				728	575	466	386	324	276	238	207	182	161	144	129	117	75	52	38	30.	26.	2	.216	70300	28
30					668	541	447	376	320	276	240	211	187	167	150	135	86	60	44	32.1	28	2.	.232	81540	30
36						773	640	537	458	395	344	302	268	239	214	194	124	86	63	38.5	33.5	2.5	.278	116700	36
42								748	637	550	478	421	372	332	298	269	172	120	88	44.9	39.5	2.5	.328	162200	42
48										729	635	558	494	441	396	357	229	159	117	51.4	45.5	2.5	.378	215300	48

Proportions, 1:6; steel reinforcement, 0.83%; K = 104; E = 3,000,000; h = depth of beam, n = 10, C = 700; f = 14,000; b = 1; d = depth of steel from top of beam.

$$M = \frac{wl^2 \times 12}{8} = Kbd^2.$$

(Reprinted from pages 80 and 81 of forthcoming book, Engineers' Pocketbook of Reinforced Concrete.)

Safe Loads per Sq. Ft. and Steel Area for Slabs.*

Continuous at ends only.

Thickness. h Ins.	Safe load per sq. ft., including weight of slab. Span in feet. 4	5	6	7	8	9	10	11	12	13	14	15	Wt. of slab per sq. ft. lbs.	Depth to steel. d. in.	Depth below steel. in.	Steel area per 1 ft. width of slab. sq. ins.	Safe moment of resistance. in. lbs.	Thickness. h. ins.
					p=0.004. C=460.													
3	163	104	72	53	40								38	2¼	¾	.108	3120	3
3½	243	156	108	79	61	48							45	2¾	¾	.132	4670	3½
4	340	217	151	111	85	67	54						51	3¼	¾	.156	6520	4
4½	394	252	175	129	98	78	63						58	3½	1	.168	7560	4½
5	514	329	229	168	129	102	82	68					64	4	1	.192	9870	5
6	803	514	357	262	201	159	129	106	.89				77	5	1	.240	15420	6
7	1157	741	514	378	289	229	185	153	129	110			90	6	1	.288	22220	7
8	1574	1008	700	514	394	311	252	208	175	149	128		103	7	1	.336	30230	8
					p=0 006; C=580.													
3	240	154	107	78	60	47	38						38	2¼	¾	.162	4610	3
3½	358	229	159	117	90	71	57	47					45	2¾	¾	.198	6880	3½
4	501	320	223	163	125	99	80	66	56				51	3¼	¾	.234	9610	4
4½	581	372	258	193	145	115	93	77	64				58	3½	1	.252	11150	4½
5	758	485	337	248	190	150	121	100	84	72			64	4	1	.288	14560	5
6	1185	758	527	387	296	234	190	157	132	112	97		77	5	1	.360	22750	6
7	1706	1092	758	557	427	337	273	226	190	162	139	121	90	6	1	.432	32760	7
8	2322	1486	1032	758	581	459	372	307	258	220	190	165	103	7	1	.504	44590	8
					p=0.008. C=680.													
3	315	202	140	103	79	62	50	41					38	2¼	¾	.216	6060	3
3½	471	302	209	154	118	93	75	62	52				45	2¾	¾	.264	9050	3½
4	658	421	293	215	165	130	105	87	73	62			51	3¼	¾	.312	12640	4
4½	763	489	339	249	191	151	121	101	85	72	62		58	3½	1	.336	14660	4½
5	997	638	443	326	249	197	160	132	111	94	81		64	4	1	.384	19150	5
6	1558	997	693	509	390	308	249	206	173	148	127	111	77	5	1	.480	29930	6
7	2244	1436	997	733	561	443	359	297	249	212	183	160	90	6	1	.576	43090	7
8	3054	1955	1358	997	764	603	489	404	339	289	249	217	102	7	1	.672	58650	8
					p=0 010. C=700													
3	349	223	155	114	87	69	56	46	39				38	2¼	¾	.270	6700	3
3½	521	334	232	170	130	103	83	69	58	49			45	2¾	¾	.330	10010	3½
4	729	466	324	238	182	144	117	96	81	69	59		51	3¼	¾	.390	13990	4
4½	845	541	375	276	211	167	135	112	94	80	69		58	3½	1	.420	16220	4½
5	1103	706	490	360	276	218	176	146	123	104	90	78	64	4	1	.480	21180	5
6	1724	1103	766	563	431	340	276	228	191	163	141	123	77	5	1	.600	33100	6
7	2482	1588	1103	810	620	490	397	328	276	235	203	176	90	6	1	.720	47660	7
8	3378	2162	1502	1103	845	667	541	447	375	320	275	240	103	7	1	.840	64880	8
					p=0 012. C=700.													
3	371	238	165	121	93	73	59	49	41				38	2¼	¾	.324	7130	3
3½	555	355	246	181	139	110	89	73	62	52			45	2¾	¾	.396	10650	3½
4	775	496	344	253	194	153	124	102	86	73	63		51	3¼	¾	.468	14870	4
4½	899	575	399	293	225	177	144	119	106	85	73	64	58	3½	1	.504	17250	4½
5	1173	751	521	383	293	232	188	155	130	111	96	83	64	4	1	.576	22530	5
6	1833	1173	815	599	458	362	293	242	204	173	150	130	77	5	1	.720	35200	6
7	2640	1690	1173	862	660	521	422	349	293	250	215	188	90	6	1	.864	50690	7
8	3593	2300	1597	1173	898	710	575	470	399	340	293	255	103	7	1	1.008	63990	8

* Proportions, 1:6. C=or < 700, f=or < 14000; E=3,000,000.

* $M = \frac{wl^2 \times 12}{10}$; $M_c = \frac{1}{2} C k \left(1 - \frac{k}{3}\right) bd^2$; $M_s = pf \left(1 - \frac{k}{3}\right) bd^2$.

Column Schedule.

Floor.	Loads in lbs. per sq. ft.	Columns 1, 5, 21, supporting panel 7½ x 7½ ft.		Columns 7, 8, 9, 12, 13, 14, 17, 18, supporting panel 15 x 15 ft.		Columns 2, 3, 4, 10, 6, 11, 15, 16, 22, 23, supporting panel 7½ x 15 ft.	
6th...	Panel load...	7,988	10-in. col. No.7 ga'ge 1% verti'l reinforcement.	31,950	Same as col. 1, 6th floor.	15,975	Same as col. 1, 6th floor.
	Column wt...	1,250		1,250		1,250	
		9,238		33,200		17,225	
5th...	Panel load...	13,837	Same as col. 1, 6th floor.	55,350	Same as col. 1, 3rd floor.	27,675	Same as col. 1, 6th floor.
	Column wt...	1,250		3,200		3,200	
	Curtain wall..	13,500		....		13,500	
		37,825		91,750		59,650	
4th...	Panel load...	13,837	Same as col. 1, 6th floor.	55,350	14-in. col. No.7 ga'ge 1% verti'l reinforcement.	27,675	Same as col. 7, 4th floor.
	Column wt...	1,250		3,200		3,200	
	Curtain wall..	13,500		....		13,500	
		66,412		150,300		104,025	
3rd...	Panel load...	13,837	10-in. col. No.7 ga'ge 3% verti'l reinforcement.	55,350	16-in. col. No.7 ga'ge 1% verti'l reinforcement.	27,675	Same as col. 7, 4th floor.
	Column wt...	2,450		3,200		3,200	
	Curtain wall..	13,500		....		13,500	
		96,199		208,850		148,400	
2nd..	Panel load...	13,837	14-in. col. No.7 ga'ge 2% verti'l reinforcement.	55,350	16-in. col. No.7 ga'ge 4% verti'l reinforcement.	27,675	Same as col. 1, basement.
	Column wt...	2,450		3,600		3,200	
	Curtain wall..	13,500		....		13,500	
		125,986		267,800		192,775	
1st...	Panel load...	13,837	Same as col. 1, 2nd floor.	55,350	20-in. col. No.7 ga'ge 1% verti'l reinforcement.	27,675	16-in. col. No.7 ga'ge 3% verti'l reinforcement.
	Column wt...	3,200		4,050		3,600	
	Curtain wall..	15,750		....		15,750	
		158,773		327,200		239,800	
Basement.	Panel load...	13,837	14-in. col. No.7 ga'ge 3% verti'l reinforcement.	55,350	20-in. col. No.7 ga'ge 3% verti'l reinforcement.	27,675	Same as col. 7, 1st floor.
	Column wt...	3,600		4,050		3,600	
	Curtain wall..	13,500		....		13,500	
		189,710		386,600		284,575	
Foundation..	At 5,000 lbs. per sq. ft., or 2.5 tons.	94.86 tons.	37.94 sq. ft.	193.3 tons.	77.3 sq. ft.	142.3 tons.	56.9 sq. ft.

Column Schedule—Continued

Floor.	Loads in lbs. per sq. ft.	Columns 20, 24 Supporting panel 7½ x 15 ft.		Column 19. Supporting panel 15 x 15 ft.		Column 25. Supporting panel 7½ x 7½ ft.	
6th...	Wt. of garner	50,000	10-in. col. No.7 ga'ge 3% verti'l reinforcement	50,000	Same as col. 20, 6th floor.	50,000	10-in. col. No.7 ga'ge 1% verti'l reinforcement.
	Panel load...	15,975		31,950		7,988	
	Column wt...	3,600		3,600		2,450	
		69,575		85,550		60,438	
5th..	Panel load..	27,675	14-in col. No.7 ga'ge 1% verti'l reinforcement.	55,350	Same as col 20, 5th floor	13,837	Same as col 20, 6th floor.
	Column wt .	3,600		3,600		2,450	
	Curtain wall..	13,500		... .		13,500	
		114,350		144,500		90,225	
4th...	Panel load .	27,675	Same as col 20, 5th floor.	55,350	14-in. col. No.7 ga'ge 3% verti'l reinforcement.	13,837	14 in col. No 7 ga'ge 2% verti'l reinforcement.
	Column wt..	3,600		3,600		3,200	
	Curtain wall..	13,500		......		13,500	
		159,125		203,450		120,762	
3rd...	Panel load .	27,675	16-in. col No.7 ga'ge 1% verti'l reinforcement.	55,350	16-in. col. No.7 ga'ge 3% verti'l reinforcement.	13,837	Same as col. 25, 4th floor.
	Column wt...	3,600		3,600		3,200	
	Curtain wall.	13,500		. ...		13,500	
		203,900		262,400		151,299	
2nd..	Panel load...	27,675	16-in col. No.7 ga'ge 4% verti'l reinforcement.	55,350	Same as col.20, 1st floor.	13,837	Same as col. 19, 4th floor.
	Column wt...	3,600		4,000		3,600	
	Curtain wall..	13,500		.		13,500	
		248,675		321,750		182,236	
1st...	Panel load...	27,675	20-in. col. No.7 ga'ge 1% verti'l reinforcement.	55,350	20-in. col. No.7 ga'ge 3% verti'l reinforcement.	13,837	Same as col. 20, 3rd floor.
	Column wt..	4,000		4,800		4,000	
	Curtain wall..	15,750		......		15,750	
		296,100		381,900		215,823	
Basement.	Panel load..	27,675	Same as col. 20, 1st floor.	55,350	22-in. col. No.7 ga'ge 2% verti'l reinforcement.	13,837	Same as col. 19, 3rd floor.
	Column wt..	4,000		4,000		3,600	
	Curtain wall..	13,500		..... .		13,500	
		341,275		441,250		246,760	
Foundation..	At 5,000 lbs. per sq. ft., or 2.5 tons.	170.6 tons.	68.25 sq. ft.	220.6 tons.	88.2 sq. ft.	123.4 tons.	49.4 sq. ft.

(Reprinted from page 85 of forthcoming book, Engineers' Pocketbook of Reinforced Concrete.)

Hooped Columns, Considère's Formula.

Ultimate Loads, High Carbon Steel.

For working loads, divide by 4.

Diameter of Column in. ins.	Diameter of Spiral in. ins.	Percentage of vertical reinforc'ment	No. 7 gauge. Area = 0.023 sq. ins. 1 in. pitch.	¼-in. round. Area = 0.0491 sq. ins. 1½ ins. pitch.	⅜-in. round. Area = 0.1104 sq. ins. 1½ ins. pitch.
10	8	1	365,000	311,000	407,000
		2	385,000	330,000	430,000
		3	405,000	350,000	447,500
12	10	1	528,000	460,000	581,000
		2	560,500	491,000	612,500
		3	590,000	522,500	643,000
14	12	1	720,500	638,000	784,000
		2	765,500	683,500	830,000
		3	810,500	728,000	875,000
16	14	1	941,500	846,000	1,016,000
		2	1,003,000	907,000	1,077,500
		3	1,064,500	969,000	1,139,000
18	16	1	1,191,500	1,082,000	1,276,500
		2	1,272,000	1,162,500	1,357,000
		3	1,353,000	1,243,000	1,437,000
20	18	1	1,470,000	1,338,000	1,566,000
		2	1,572,000	1,439,500	1,668,000
		3	1,674,000	1,541,000	1,769,500
22	20	1	1,778,000	1,641,500	1,884,500
		2	1,903,500	1,767,000	2,010,000
		3	2,029,000	1,893,000	2,136,000
24	22	1	2,115,000	1,964,500	2,232,000
		2	2,267,000	2,116,500	2,384,000
		3	2,419,000	2,268,500	2,536,000
26	24	1	2,480,500	2,316,500	2,608,000
		2	2,661,500	2,497,500	2,789,000
		3	2,842,000	2,678,500	2,970,000
28	26	1	2,875,000	2,697,500	3,013,000
		2	3,087,000	2,909,500	3,225,500
		3	3,299,500	3,122,000	3,437,500
30	28	1	3,298,000	3,107,000	3,447,000
		2	3,544,500	3,353,000	3,693,500
		3	3,790,500	3,599,500	3,939 500

We will use a column with high carbon wire hooping, and employ different percentages of vertical reinforcement, according to Considiere's formula, and table, page 85*. The values in this table being ultimate, are divided by 4 to get the working stress. The 90,000 lbs. for No. 7 gauge represents the elastic limit of the wire employed. The other tables for column loads could be used—see pages 86 to 91, and page 46†.

The calculations are made, bearing in mind that the roof load is 142 lbs. per sq. ft., the floor loads 246 lbs. per sq. ft. The weight of the column is approximate, allowing for not having included brackets, etc.

The spiral in each case is 2 ins. less in diameter than the column for same, and all spirals used are on 1-in. pitch, as shown in Considere's table.

(To be continued).

Bids for New York State Barge Canal work are now being taken by the State Superintendent of Public Works. The bids are to be opened July 31 and call for work under three contracts: Contract No. 12—Erie Canal—Sections 6 and 7; Contract No. 14—Erie Canal—Sections 1, 2 and 3; Contract No. 35—Oswego Canal—Section 1. Contract No. 12 covers a total length of the canal of 43.73; Contract No. 14 covers a length of 15 miles and Contract No. 35 covers .85 of a mile. The last contract, however, includes excavating the canal and protecting its sides; constructing Locks Nos. 7 and 8; bulkheads; culverts; spillways, and incidental details between 0.56 of a mile above Utica Street Bridge, Station 1164+00, and the harbor line north of Bridge Street Bridge, Station 1208+85, at Oswego, N. Y.

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*Reprinted opposite column, this page.

†Not reprinted.

Catalogs Worth Having.

No. 0284. **Forged Steel Pipe Flanges.**—American Spiral Pipe Works, New York, Chicago.

In this handsomely printed catalog the company named presents not only a complete list of standard flanges, but also a short description of the more important features of the Forged Steel Flange. The conditions under which steam piping is used at the present time are far different in respect to pressure and degree of superheat than they were a number of years ago. These conditions are thought to call for a stronger and tougher construction of pipe connection than was necessary in the old days. The Forged Steel Flange, of the company named above, is claimed to represent this improvement and its description and illustration in this catalog should be of interest to all of our readers using steam pipe.

No. 0285. **Vertical Steam Engines.**—Bates Machine Company, Joliet, Ill.

The company issuing this catalog has long been known for the manufacture of Corliss Engines. The automatic high-speed engine described in the catalog is a somewhat new departure. It is claimed to contain a number of improvements in design and construction and to be especially adapted to the operation of electric generators. The catalog is well printed and the descriptive matter is sufficiently complete to give a clear understanding of the several sizes and types of machines illustrated.

No. 0286. **Dipper Dredges.**—The Fairbanks Steam Shovel Co., Marion, Ohio.

The firm named above, comparatively speaking, is a new firm in the field of dredge construction. The catalog which they issue shows a number of sizes of dredges and describes in detail the peculiarity of their construction. The illustrations consist both of line drawings and half-tone views, and together with the text will give a clear understanding of the new machine.

No. 0287. **Concrete Mixers.**—The Hartwick Machinery Co., Jackson, Mich.

The Concrete Mixer built by the firm named above is known as the "Scheiffler Proportioning Mixer." Briefly described, it is a continuous trough mixer mounted on trucks and operated by a vertical engine. The materials are fed into hoppers from which they are automatically distributed to the mixing trough in exactly the proportions required by the engineer. The catalog describes this mixer in detail and presents an argument in favor of continuous mixers as compared with batch mixers, for general concrete work.

No. 0288. **Sullivan's Patent Steel Plank Holder.**—J. H. Sullivan, Grand Rapids, Mich.

This is a well written descriptive catalog. The device described is a stamped metal clamp for holding lagging boards of concrete forms. By the use of the holder no nailing of the form boards is necessary. They can be used over and over again, and the holder being interchangeable can be applied at any time or place in wall construction of any sort. It is also adapted to holding the lagging boards for the roof arches of sewers.

No. 0289. **Cement Workers' Tools.**—The Contractors' Tool Co., Philadelphia, Pa.

This is a brief descriptive catalog and price list of the various cement workers' tools manufactured by the company named. The tools include jointers, groovers, edgers and similar special tools used in concrete sidewalk and curb and gutter construction.

No. 0290. **Pneumatic Hammers.**—The Dayton Pneumatic Tool Co., Dayton, O.

The line of tools manufactured by this company and listed in this catalog lays especial claim to simplicity of construction. It is claimed that no other hammer has so few parts or so little variance in the size of the parts for different size hammers.

Personals.

Messrs. James B. Brown, W. N. Cox and T. J. Humphreys have been appointed members of the Board of Public Works of Louisville, Ky.

Mr. W. D. Wheeler, of Minneapolis, Minn., has been appointed Chief Engineer of the Iowa Central and Minneapolis and St. Louis Railroads.

Mr. John Berg, of 211 E. 15th St., New York, has been appointed temporary Assistant Engineer Designer, Board of Water Supply, of New York City.

Mr. Henry S. Washington and Mr. J. Volney Lewis have opened an office at 95 Liberty St., New York City, as expert specialists and consulting geologists.

Mr. John F. Stevens, formerly Chief Engineer of the Isthmian Canal Commission, has been elected Vice President of the New York, New Haven & Hartford R. R.

Waddell & Harrington, Consulting Engineers, New Nelson Bldg., Kansas City, Mo., have been retained to design a bridge over the Waikato River for the town of Hamilton, New Zealand.

Messrs Leland W. Irish, Barge Canal Office, Albany, N. Y., and Harry R. Bouton, 52 Van Zant St., Norwalk, Conn., have been appointed Assistant Engineers to the Board of Water Supply of New York City.

Mr. Clarence L. Carman, of 601 West 138th St., New York City, has been promoted from the position of Draftsman in the Department of Bridges, New York City, to the position of Assistant Engineer in that department.

Dr. Walter A. Bensel, formerly Sanitary Superintendent of the City Health Department, has been appointed Commissioner of Street Cleaning of New York City, succeeding Mr. McDonough Craven, who resigned on account of ill health.

Prof. J. B. Davis, of the University of Michigan, has been selected by the Attorney General of the State of Michigan under authority of a law passed by the legislature, to assist in locating the boundary line between Michigan and Wisconsin.

Mr. William J. Wilgus, Vice President of the New York Central & Hudson River R. R., in charge of construction, has tendered his resignation to take effect Oct. 1. Mr. Wilgus has been in direct charge of the reconstruction of the Grand Central Terminals in New York City and the work of changing from steam to electric power in the Electric Zone. His resignation was not entirely unexpected for several times during the past two years he has indicated his desire to retire.

Prof. Mortimer E. Cooley, Capt. Azel Ames, Jr., Frank G. Ewald and B. B. Adams have been appointed by the Interstate Commerce Commission as a board of experts to supervise and conduct experimental tests of block signal systems and other safety devices used on railroads in the United States. Prof. Cooley, who has been named as chairman of the board is Dean of the Department of Engineering at the University of Michigan. Capt. Ames is at present Engineer in direct charge of signaling in the Electric Zone of the New York Central and Hudson River R. R. Mr. Frank G. Ewald has been Consulting Engineer of the Railroad and Warehouse Commission of the State of Illinois for the past ten years. Mr. B. B. Adams has for 20 years been one of the editors of the Railroad Gazette, and is a recognized authority on signaling.

Mr. Frank Richards has been made managing editor of Compressed Air, which will hereafter be published by the Compressed Air Magazine Co., with offices in the Bowling Green Building, New York. Mr. W. L. Saunders remains as editor and Mr. Lucius I. Wightman will become manager of the new organization. Mr. Richards, the new managing editor, is well known as the author of the book "Compressed Air," which remains today the standard text-book on this subject. He was for ten years one of the editors of the American Machinist and his articles in that paper, over various signatures, have long been recognized as of the highest practical value. Previous to his work on the American Machinist, Mr. Richards spent some years in machine manufacturing, part of the time as superintendent of shops of the Ingersoll-Sergeant Drill Co.

CONTRACT NEWS

We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Bids Open.		See Issue.
July 25.	Boston, Mass	July 24
July 25.	Sacramento, Cal	July 24
July 26.	Elkhart, Ind	July 17
July 27.	Cleveland, O.	July 3
July 27.	Elberton, Ga.	July 10
July 29.	Chardon, O.	July 3
July 29.	Tiffin, O	July 17
July 29.	Wichita, Kan	July 17
July 29.	Danville, Ind	July 24
July 30.	Waterbury, Conn	July 24
July 30.	New York, N. Y	July 24
July 30.	Hamilton, O	July 17
July 31.	Hattiesburg, Miss.	July 10
July 31.	Glencoe, Ill	July 24
Aug. 1.	East St. Louis, Ill	July 17
Aug. 1.	Woodland, Cal	July 17
Aug. 1.	Milwaukee, Wis	July 24
Aug. 3.	Ottawa, Ont	July 24
Aug. 3.	Washington C. H., O	July 24
Aug. 3.	Findlay, O	July 24
Aug. 3.	Cleveland, O.	July 10
Aug. 5.	Jackson, O.	July 10
Aug. 5.	Rome, Ga	July 17
Aug. 5.	New Bern, N. C	July 17
Aug. 5.	Vicksbury, Miss	July 24
Aug. 5.	Columbus, O	July 24
Aug. 5.	Bluffton, Ind	July 24
Aug. 5.	Newton, Kan	July 24
Aug. 5.	Valparaiso, Ind	July 24
Aug. 5.	Tipton, Ind	July 24
Aug. 5.	Noblesville, Ind	July 24
Aug. 5.	Lebanon, Ind	July 24
Aug. 5.	Crown Point, Ind	July 24
Aug. 5.	Troy, O	July 24
Aug. 6.	Cleveland, O	July 24
Aug. 6.	Brazil, Ind	July 24
Aug. 6.	New Lexington, O	July 24
Aug. 6.	Brownstown, Ind	July 24
Aug. 6.	Covington, Ind	July 17
Aug. 7.	Peru, Ind	July 24
Aug. 8.	New Albany, Ind	July 24
Aug. 7.	Warsaw, Ind	July 24
Aug. 8.	Zanesville, O	July 24
Aug. 10.	Cleveland, O	July 17
Aug. 15.	Mount Gilead, O	July 24
Aug. 15.	Jackson, O	July 24
Aug. 16.	Cincinnati, O	July 24
Aug. 20.	San Juan, P. R	July 24
Sept. 30.	Santiago, Chile	July 17

Buildings

July 24.	Lincoln, R. I	July 17
July 24.	Clarksburg, W. Va	July 17
July 24.	Hoboken, N. J	July 10
July 24.	Fort Sam Houston, Tex.	July 3
July 24.	Aurora, Ill.	June 26
July 25.	Marion, Ind.	July 10
July 25.	New York, N. Y	July 17
July 25.	Newark, N. J	July 17
July 25.	New Roads, La	July 17
July 25.	Marietta, O	July 17
July 26.	Chicago, Ill	July 17
July 27.	Potosi, Mo.	July 10
July 27.	Colfax, Ind	July 24
July 27.	Indianapolis, Ind	July 24
July 27.	Albany, N. Y	July 24
July 27.	Washington, D. C	July 24
July 29.	Two Rivers, Wis	July 24
July 29.	Columbus, O	July 24
July 29.	New York, N. Y	July 24
July 29.	New York, N. Y	July 24
July 29.	Boston, Mass	July 24
July 29.	Yuma, Ariz.	July 10
July 29.	Jackson, Mich	July 17
July 30.	Ames, Ia	July 17
July 30.	Fort Brady, Mich	July 24
July 30.	Pittsburg, Kan	July 24
July 30.	Norfolk, Va	July 24
July 31.	Ravena, N. Y	July 24
July 31.	Owosso, Mich	July 17
July 31.	Washington, D. C	July 17
July 31.	Owosso, Mich.	July 3
Aug. 1.	Washington, D. C	July 10
Aug. 1.	Bowling Green, Va	July 17
Aug. 1.	New York, N. Y	July 24
Aug. 1.	Houston, Va	July 24
Aug. 1.	Union, Ind	July 24
Aug. 4.	Hannaford, N. Dak	July 17
Aug. 5.	Tallahassee, Fla	July 17
Aug. 5.	Cleveland, O	July 17
Aug. 5.	Crookston, Minn.	July 3
Aug. 5.	New York, N. Y	July 24
Aug. 5.	Leavenworth, Kan	July 24
Aug. 6.	Shelby, N. C	July 24
Aug. 6.	Columbus, O.	July 10
Aug. 6.	Brooklyn, N. Y	July 17
Aug. 6.	Asheville, N. C	July 17
Aug. 6.	Wabash, Ind	July 17
Aug. 7.	Halifax, N. S	July 17
Aug. 7.	Baltimore, Md	July 24
Aug. 9.	Lakewood, O	July 24
Aug. 9.	Lakewood, O	July 17
Aug. 9.	Monticello, Ind.	July 3
Aug. 12.	Mason City, Ia.	July 3
Aug. 14.	Springfield Township, O.	July 24
Aug. 15.	Albany, N. Y	July 24
Aug. 15.	North Chicago, Ill	July 24
Aug. 15.	Bakersville, N. C	July 17
Aug. 15.	Terre Haute, Ind	July 24
Aug. 17.	Peru, Ind	July 24
Aug. 19.	Alexandria, Minn	July 17
Aug. 20.	Decatur, Ill	July 17
Aug. 20.	Spearfish, S. Dak	July 24
Aug. 20.	Montevallo, Ala	July 24
Aug. 22.	Jackson, Miss	July 24
Aug. 22.	Jackson, Mich	July 17
Aug. 24.	Geneva, Ill	July 17

Roads and Streets.

July 25.	Freeport, Ill	July 24
July 25.	Newark, N. J	July 24
July 25.	Jersey City, N. J	July 17
July 25.	New York, N. Y	July 17
July 25.	El Reno, Okla	July 17
July 26.	Tipton, Ind	July 17
July 26.	Appleton, Wis	July 17
July 26.	Cincinnati, O.	July 10
July 26.	Indianapolis, Ind	July 24
July 26.	Milwaukee, Wis	July 24
July 27.	Marion, O	July 24
July 27.	Oberlin, O	July 24
July 27.	Belleville, Ill	July 24
July 27.	Greencastle, Ind	July 17
July 27.	Olympia, Wash	July 17
July 27.	Cleveland, O.	July 3
July 29.	Shawano, Wis	July 17
July 29.	Milwaukee, Wis	July 24
July 29.	Jenkintown, Pa	July 24
July 29.	Albany, N. Y	July 24
July 29.	New Orleans, La	July 24
July 29.	Indianapolis, Ind	July 24
July 29.	McDonald, Pa	July 24
July 29.	Syracuse, N. Y	July 24
July 29.	Kansas City, Mo	July 24
July 29.	St. Paul, Minn	July 24
July 29.	Galveston, Tex	July 24
July 29.	Toledo, O	July 24
July 30.	Defiance, O	July 24
July 30.	Wilmington, Del	July 24
July 30.	Clinton, Ia	July 24
July 30.	Newark, N. J	July 17
July 30.	Ashland, Ore	July 17
July 30.	Steubenville, O	July 17
July 30.	Des Moines, Ia	July 17
July 30.	Jefferson, O.	July 10
July 30.	DesMoines, Ia.	July 10
July 30.	Hagerstown, Md.	July 10
July 31.	Kansas City, Mo	July 10
July 31.	Fort Greble, R. I	July 17
July 31.	Baltimore, Md	July 24
July 31.	Brooklyn, N. Y	July 24
Aug. 1.	Kansas City, Mo	July 24
Aug. 1.	St. Paul, Minn	July 24
Aug. 1.	Brooklyn, N. Y	July 24
Aug. 1.	Frostburg, Md.	July 24
Aug. 1.	Rahway, N. J	July 17
Aug. 1.	Greencastle, Ind	July 17
Aug. 1.	Greencastle, Ind.	July 3
Aug. 2.	Cincinnati, O.	July 10
Aug. 3.	St. Clairsville, O	July 17
Aug. 3.	New Bremen, O	July 17
Aug. 3.	Terre Haute, Ind	July 24
Aug. 5.	Plainfield, N. J	July 24
Aug. 5.	Columbus, Ind	July 24
Aug. 5.	Fort Mackenzie, Wyo	July 24
Aug. 5.	Toledo, O	July 24
Aug. 5.	Mount Vernon, Ind	July 24
Aug. 5.	English, Ind	July 24
Aug. 5.	Carlinville, Ill	July 24
Aug. 5.	Montgomery, Ala	July 24
Aug. 5.	Greensburg, Ind	July 17
Aug. 5.	Olympia, Wash	July 17
Aug. 5.	Sullivan, Ind	July 17
Aug. 5.	Boonville, Ind.	July 10
Aug. 6.	Sharpsville, Pa.	July 10
Aug. 6.	Sewickley, Pa	July 24
Aug. 6.	Edgewater, N. J	July 24
Aug. 6.	Washington, Pa	July 24
Aug. 6.	Napoleon, O	July 24
Aug. 6.	Spencer, Ind	July 24
Aug. 6.	Covington, Ind	July 24
Aug. 7.	Rockville, Ind	July 24
Aug. 7.	Peru, Ind	July 24
Aug. 7.	Des Moines, Ia	July 24
Aug. 9.	Monessen, Pa	July 24
Aug. 10.	Struthers, O	July 24
Aug. 10.	Lisbon, O	July 24
Aug. 10.	Findlay, O	July 24
Aug. 10.	Celina, O	July 24
Aug. 13.	Huntington, Ind	July 24
Aug. 20.	Cleveland Heights, O	July 24
Aug. 17.	Cleveland, O	July 24
Aug. 20.	Cleveland Heights, O	July 24

Sewers.

July 24.	Brooklyn, N. Y	July 17
July 24.	Cleveland, O	July 17
July 24.	Oakland, Cal.	July 10
July 24.	Aberdeen, Wash.	July 10
July 24.	Henderson, N. C	July 10
July 25.	Janesville, Wis.	July 10
July 25.	Frankfort, Ind.	June 19
July 25.	Frankfort, Ind.	June 26
July 26.	Buffalo, N. Y	July 17
July 27.	Evansville, Ind	July 17
July 27.	Wahpeton, N. Dak	July 24
July 27.	Fond du Lac, Wis	July 24
July 27.	Cape May, N. J	July 24
July 27.	Belleville, Ill	July 24
July 29.	Pekin, Ill	July 24
July 29.	Hartford, Conn	July 24
July 29.	New Castle, Pa	July 17
July 30.	DesMoines, Ia.	July 10
July 30.	New York, N. Y	July 24
July 30.	Milwaukee, Wis	July 24
July 30.	Newport, R. I	July 24
July 30.	Napoleon, O	July 24
July 30.	Des Moines, Ia	July 17
July 31.	Brooklyn, N. Y	July 24
Aug. 1.	Kansas City, Mo	July 24
Aug. 1.	Bloomfield, N. J	July 24
Aug. 1.	Scottdale, Pa	July 24
Aug. 2.	Youngstown, O	July 24
Aug. 3.	New Bremen, O	July 17
Aug. 5.	Grand Forks, N. Dak	July 17
Aug. 5.	Plainfield, N. J	July 17
Aug. 5.	North Milwaukee, Wis.	July 17
Aug. 6.	Alexandria, La.	July
Aug. 6.	McKeesport, Pa	July 24
Aug. 8.	Bloomfield, Ind	July 17
Aug. 12.	Willmar, Minn	July 24
Aug. 12.	Marshfield, Wis	July 24
Aug. 15.	Camden, Ark	July 24
Aug. 19.	Port Clinton, O	July 24
Aug. 20.	Cleveland Heights, O	July 24
Aug. 22.	Fayetteville, Ark	July 24
Aug. 30.	Evansville, Ind	July 24
Sept. 11.	New Orleans, La	July 10

Water Supply.

July 25.	Bradentown, Fla	July 17
July 25.	Cissna Park, Ill	July 17
July 26.	Decatur, Ill.	July 10

July 29. West Point, N Y. ....July 17
July 29. Boone, Ia....................July 24
July 31. North Battleford, Sask. ..July 3
Aug. 1. Jamestown, N. Y.........July 17
Aug. 1. Chewelah, Wis.............July 24
Aug. 2. Withee, Wis................July 24
Aug. 5. Thayer, Ill..................July 24
Aug. 5. Decorah, Ia..... ......July 17
Aug. 5. Fort Adams, R. I.........July 17
Aug. 6. Cherokee, Ia...............July 17
Aug. 7. Steelton, Pa................July 17
Aug. 8. Fort Oglethorpe, Ga......July 17
Aug. 9. Fort Hancock, N. J.......July 17
Aug. 12. Belle Plaine, Minn.........July 24
Aug. 13. Columbus, O..............July 17
Aug. 19. Sacramento, Cal. ....June 5
Aug 20. Russellville, Ark..........July 24
Sept. 4. New Orleans, La. ....July 3

Miscellaneous.

July 24. Chicago, Ill.
High Pressure Piping, July 17
July 24. Baltimore, Md.
Refuse Removal, July 17
July 26. Toledo, O.
Power Plant, July 17
July 26. New York, N. Y.
Freight Sheds, July 17
July 26. Holland, Mich.,
Pier Repairs, July 3
June 26. Winnetka, Ill.,
Pile Pier, June 26
July 27. Boston, Mass.,
Concrete Floor, July 3
July 29. Milford Haven, Va.,
Riprap Jetties, July 10
July 29. New Orleans, La.,
Track Work, July 24
July 30, New York, N. Y.,
Chimney, Etc., July 24
July 30. Fort Monroe, Va.,
Track Work, July 10
July 30. New York, N. Y.,
Retaining Wall, July 3
July 31. Tacoma, Wash.
Power Plant, July 17
Aug. 1. Washington, D. C.,
Torpedo Boats, June 5
Aug. 1. New York, N. Y.,
Greenhouse, July 24
Aug. 1. Brooklyn, N. Y.,
Refuse Disposal, July 24
Aug. 2. Racine, Wis.,
Breakwaters, July 10
Aug. 3. Jackson Barracks, La.
Wharf Repairs, July 17
Aug. 3. San Juan, R. I.,
Pier Repairs, June 26
Aug. 5. Harrisburg, Pa.,
Garbage Disposal, June 26
Aug. 5. Somers Point, N. J.,
Wharf, Grading, July 24
Aug. 5. Boston, Mass.,
Conduit, July 24
Aug. 5. Fort Adams, R. I.,
Wire Fence, July 24
Aug. 6. Mount Vernon, Ind.,
Concrete Dam, July 24
Aug. 6. Cleveland Heights, O.,
Street Lighting, July 10
Aug. 6. New York, N. Y.,
Dams, July 10
Aug. 8. Fort Omaha, Neb.,
Gas House, Etc., July 24
Aug. 12. Brownsville, Pa.
Lock, Walls, Etc., July 17
Aug. 16. Galveston, Tex.,
Jetty Work, July 24
Aug. 19. Washington, D. C.,
Steam Vessel, July 24
Aug. 20. San Diego, Cal.,
Wharf and Trestle, June 26
Aug. 24. Bremerton, Wash.,
Concrete Quay Wall, July 24
Aug. 31. Lebanon, Pa.,
Street Lighting, July 24
Sept. 3. Winnipeg, Man.,
Hydro-Electric Development, June 19

Excavation, Earth and Rock.

July 24. Jacksonville, Fla.,
Dredging, June 26
Aug. 24. New York, N. Y.,
Dredging, July 3
July 24. New York, N. Y.,
Dredging, July 3
July 24. Carroll, Ia.,
Ditch Work, July 3
July 27. Woodbridge, N. J.,
Dredging, July 3
July 29. Skagway, Alaska,
Dredging, Etc., June 19
July 30. Newark, N. J.,
Dredging, July 3
July 31. Albany, N. Y.,
Barge Canal Work, July 10
July 31. Galveston, Tex.,
Dredging, July 10
July 31. Piper City, Ill.,
Ditch Work, July 24
Aug. 1. New York, N. Y.,
Grading, July 24
Aug. 1. Marshalltown, Ia.,
Drainage Ditch, July 10
Aug. 1. Emmetsburg, Ia.,
Drainage Work, July 3
Aug. 1. Nevada, Ia.,
Ditch Work, July 3
Aug. 1. Milner, Idaho.
Irrigation Canal, July 17
Aug. 2. Nevada, Ia.
Ditch Work, July 17
Aug. 2. Hooppole, Ill.,
Ditch Work, July 24
Aug. 5. Sullivan, Ind.,
Ditch Work, July 24
Aug. 5 Wilmington, Del.
Dredging, July 24
Aug. 5. Greenfield, Ind.
Ditch Work, July 17
Aug. 6. Newton, Ia.
Ditch Work, July 17
Aug. 6. Pocahontas, Ia.
Drainage Work, July 17
Aug. 7. San Juan, P. R.,
Dredging, July 3
Aug. 10. Portsmouth, N. H.,
Filling, July 24
Aug. 12. Philadelphia, Pa.,
Dredging, July 24
Aug. 12. Washington, D. C.,
Dredging, July 24
Aug 12 Norwalk, Conn.
Dredging, July 17
Aug. 15. Cheboygan, Mich.,
Dredging, July 24
Aug. 16. Tampa, Fla.,
Dredging, July 24
Aug. 22. Brunswick, Ga.,
Dredging, July 24

Materials, Machines, Supplies, Tools Etc

July 24. New York, N. Y.
Fire Alarm Supplies, July 17
July 25. Brooklyn, N. Y.
Limestone, July 17
July 25. Brooklyn, N. Y.
Top Soil, July 17
July 25. Omaha, Neb.,
Electric Elevator, July 3
July 25. Newark, N. J.,
Street Sweeping Machines, July 24
July 26. Youngstown, O.,
Fire Hydrants, July 24
July 29. New Orleans, La.,
Locomotive, July 24
July 30. New York, N. Y.,
Trap Rock, July 24
July 30. New York, N. Y.,
Boilers, Laundry Machinery, July 24
July 30. Chicago, Ill.,
Crushed Limestone, July 24
July 30. Charleston, S. C.,
Motor Drive Outfits, July 24
July 30. New York, N. Y.,
Pipe, Pumps, Etc., July 24
July 30. Boston, Mass.,
Air Hose, Pipe, Etc., July 24
July 30. Pensacola, Fla.,
Ties, Electrical Supplies, Etc., July 24
July 30. Washington, D. C.,
Cable, Paving Blocks, Etc., July 24
July 30. Washington, D. C.
Pipe, Pumps, Rope, Etc., July 17
July 30. San Francisco, Cal.,
Boilers, July 3
July 30. Fort Monroe, Va.,
Locomotive, Cars, July 10
July 30. Columbus, O.,
Engine, Dynamo, Etc., July 10
July 31. Washington, D. C.
Steel Shelving, July 17
July 31. New York, N. Y.,
Ice Making Plant, July 24
July 31. Washington, D. C.,
Radiators, July 24
Aug. 1. New York, N. Y.,
Broken Stone, July 24
Aug. 1. St. Paul, Minn.,
Street Signs, July 27
Aug. 2. Washington, D. C.,
Dump Cars, July 24
Aug. 3. Williamsport, Pa.,
Paving Machinery, July 24
Aug. 3. Norwood, O.,
Water Meters, July 24
Aug. 6. Puget Sound, Wash.,
Pipe, Cement, Chain, Etc., July 24
Aug. 6. Mare Island, Cal.,
Wire, Steel, July 24
Aug. 6. Millvale, Pa.,
Fire Hose, July 24
Aug. 8. Washington, D. C.,
Rails, Ties, Piles, Etc., July 24
Aug. 10. Portsmouth, N. H.
Elevator, July 17
Aug. 14. Wheeling, W. Va.,
Iron and Steel, July 24
Aug. 16. Chicago, Ill.,
Machinery, July 24

BIDS ASKED.

Bridges.

Items Arranged Alphabetically by States.

Anniston, Ala.—Bids will be received at August term of Commissioners' Court for building a bridge over Coldwater Creek. W. F. Hanna is President.

Sacramento, Cal.—Bids are asked by County Supervisors, W. B. Hamilton, clerk, until 11 a. m., July 25, for the construction of a bridge over American River at Fair Oaks. Work includes a steel truss and reinforced concrete bridge, consisting of two steel spans, each 200 ft. long and one steel span 70 ft. in length, with concrete piers on pile foundations, and 480 lin. ft. of reinforced concrete bridge designed with 40-ft. spans. Also embankment approaches, requiring 15,500 cu. yds. of filling. Approaches and concrete bridge are to be surfaced with macadam.

Waterbury, Conn.—Bids are asked by this city, until July 30, for building steel-concrete bridge over Mad River on line of Liberty St. R. A. Cairns is City Engineer.

Glencoe, Ill.—Bids are asked by Commissioners of Cook County, Chicago, Ill., until July 31 for a reinforced-concrete arch bridge of 40-ft. span at Glencoe. Plans and specifications may be seen at the office of Harry I. Orwig, 121 La Salle St., Chicago.

Bluffton, Ind.—Bids are asked by Commissioners of Wells County, at Bluffton until 1 p. m. Aug. 5, for the construction of nine bridges.

Brazil, Ind.—Bids are asked by Commissioners of Clay County, at Brazil, until 11:30 a. m., Aug. 6, for the construction of a bridge across Eel River and a gravel road in Lewis township.

Crown Point, Ind.—Bids are asked by

Chas. A. Johnson, County Auditor, until Aug. 5, for the construction of an iron bridge on Front st. over Duck Creek in the town of Hobart.

Danville, Ind.—Bids are asked by Commissioners of Hendricks County, until July 29, for the construction of the following bridges: Otterman bridge in Eel River Township, Odum bridge in Union Township, repair of Brazelton Hadley bridge in Guilford Township.

Lebanon, Ind.—Bids are asked by Commissioners of Boone County, at Lebanon, until 10 a. m., Aug. 5, for the construction and repair of twelve bridges in said county.

New Albany, Ind.—Bids are asked by Commissioners of Floyd County, until noon, Aug. 8, for the erection of a bridge over Big Indian Creek at Stiller's Ford, in line between Lafayette and Greenville Townships.

Noblesville, Ind.—Bids are asked by Commissioners of Hamilton County, until Aug. 5, for repair of Cool Creek bridge and Levi bridge, and for the construction of a retaining wall at Ohio River bridge in Noblesville.

Peru, Ind.—Bids are asked by Commissioners of Miami County, at Peru, until noon, Aug. 7, for the construction of bridges across Big Pipe Creek, near Santa Fe.

Brownstown, Ind.—Bids are asked by H. W. Wacker, County Auditor, until 1 p. m., Aug. 6, for the construction and erection of Crow sewer or bridge substructure on Medora and Sparksville gravel road, 3 miles southwest of Medora; same to be stone or concrete.

Tipton, Ind.—Bids are asked by Commissioners of Tipton County, at Tipton, until 2 p. m., Aug. 5, for the construction of an abutment and extension of South Main st. bridge.

Valparaiso, Ind.—Bids are asked by Commissioners of Porter County, at Valparaiso, until noon, Aug. 5, for the construction of three bridges.

Warsaw, Ind.—Bids are asked by Kosciusko County Commissioners, until 10 a. m., Aug. 7, for the construction of four steel bridges and seven pairs of abutments.

Newton, Kan.—Bids are asked by B. O. Hazen, County Clerk, until Aug. 5, for the building of the following pile bridges: One over the west branch of the Whitewater, one over Sand Creek, and one over Sand Creek between sections 19 and 30 in Newton County.

Boston, Mass.—Bids are asked by P. F. McDonald, Superintendent of Bridges, 926 Tremont Bldg., until noon, July 25, for rebuilding Meridian st. bridge. Certified check for $1,000 required with bid.

Vicksburg, Miss.—Bids are asked by the Chancery Clerk of Warren County, until Aug. 5, for building a steel bridge over Jordan Creek on Road No. 76.

New York, N. Y.—Bids are asked by George Cromwell, President Richmond Borough, St. George, New Brighton, until noon, July 30, for furnishing labor and materials required for constructing a pile and timber bridge across Fresh Kills Creek at Union Ave. and furnishing and driving and capping nine piles at Bay View Ave. crossing of Lemon Creek, Princes Bay; and furnishing and driving about 180 small piles at the Fresh Kills road crossing of Mill Creek, Richmond Valley. Security required is $600.

Columbus, O.—Bids are asked by County Commisisoners, W. C. Cussins, County Auditor, until Aug. 5, for labor and material for the following bridge work: Engineers' Estimate No. 753, constructing approaches, etc., to Chillicothe Pike bridge over Big Walnut Creek in Hamilton Township; No. 779, superstructure No. 780, substructure of Pegg bridge on west side of Olentangy River, Clinton Township. No. 781, superstructure of Pegg bridge. No. 782, substructure of Pegg bridge, No. 783, reinforced concrete arch bridge, Luten's patent for the Pegg bridge.

Cincinnati, O.—Bids are asked by Commissioners of Hamilton, County, Fred. Dreihs, Clerk, until noon, Aug. 16, for work under Specifications No. 636—For repair of culverts on Whiskey Run road, about ½ mile west of Winton road, Springfield, Township.

Cleveland, O.—Bids are asked by A. R. Callow, Secretary of the Board of Public Service, City Hall, until noon, Aug. 6, for furnishing all labor and material necessary to construct a reinforced concrete culvert for Giddings Brook, under East Boulevard. Certified check for $800 required with bids. Plans, etc., at office of Park Engineer.

Findlay, O.—Bids are asked by Commissioners of Hancock County, until Aug. 3, for labor and material for construction of substructure and superstructure of steel over Blanchard River.

Jackson, O.—Bids are asked by W. J. Shumate, County Auditor, until 1 p. m., Aug. 15, for the construction of two bridges in Jackson Township. Plans and specifications are now on file at the office of J. W. Turner, County Surveyor.

Mount Gilead, O.—Bids are asked by County Commissioners, until Aug. 15, for material and labor for the construction of the superstructure and substructure for a steel bridge over Whetstone Creek, Westfield Township. W. C. McFarland is County Auditor.

New Lexington, O.—Bids are asked by Geo. T. Drake, County Auditor, until noon, Aug. 6, for construction of a bridge over Rush Creek on Main st., New Lexington.

Troy, O.—Bids are asked by E. E. Pearson, County Auditor, until 10 p. m., Aug. 5, for labor and material for the construction of the superstructure of a steel automatic swing bridge over the Miami and Erie canal on Water st. in Troy. Said bridge to be 52 ft. extreme length, with 14 16 or 18 ft. clear roadway, plank floor, 125 lbs live load capacity. Bidders will submit and bid on their own plans.

Washington C. H., O.—Bids are asked by the County Auditor, until Aug. 3, for labor and materials for construction of concrete substructure for bridge over Compton Creek.

Zanesville, O.—Bids are asked by County Commissioners, L. E. Brelsford, County Auditor, until noon, Aug. 8, for labor and material for erection of bridge superstructure over Flat Run in Wayne Township. Bridge is to consist of one span 80 ft. long, with roadway 18 ft. wide.

Auburn, Pa.—Bids are asked by Borough Council, H. H. Fleisher, Clerk, until Aug. 1, for the excavation, mason work and material for the construction of the abutments for a bridge crossing Bear Creek in the Borough of Auburn.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., Aug. 1, for constructing a stationary concrete bridge with concrete abutments, and all appurtenances thereto across the Kinnickinnic River, at the intersection of 7th Ave, according to plans and specifications on file in his office. Certified check for $1,000 required with bid.

San Juan, Porto Rico.—J. J. Jimenez, Superintendent of Public Works, San Juan, will, until 10 a. m., Aug. 20, receive alternate sealed bids and plans for furnishing on a dock at San Juan, P. R., for furnishing and erecting in place, or for erecting only, three steel riveted highway bridges, spans 49 ft. 6 in., 62 ft. 3 in. and 35 ft. 3 in. long, for the Mulas, Higuero and Convento creeks, respectively, located on the Bayamon-Comerio road.

Ottawa, Ont.—Bids are asked by Fred Gelnias, Secretary Department Public Works, Ottawa, until Aug. 3, for constructing steel superstructure of bridge over Assiniboine River, at Shellmouth, Man.

Buildings.

Items Arranged Alphabetically by States.

Montevallo, Ala.—Bids are asked by Building Committee Alabama Girls' Industrial School until noon, Aug. 20, for erection of new building and additions to the dormitory, at Montevallo, in accordance with plans and specifications furnished by William Ernest, Spink, Arch., 812-813 Title Guarantee Bldg., Birmingham, Ala.

Washington, D. C.—Bids are asked by Bureau of Yards and Docks, Navy Department, Washington, until 11 a. m., July 27, for making alterations and repairs. Medical School, Washington, D. C.

North Chicago, Ill.—Bids are asked by Bureau of Navigation, Navy Department, Washington, D. C., until noon, Aug. 15, for the construction of 12 additional buildings at naval training station, Great lakes, North Chicago, in accordance with revised plans and specifications which may be obtained at actual cost of blue prints upon application to Architect Jarvis Hunt, Monadnock Bldg., Chicago, or to the Commandant, Naval Training Station, Great Lakes, North Chicago.

Colfax, Ind.—Bids are asked by Burr Bailey, Trustee of Perry Township, at Colfax, until 2 p. m., July 27, for the construction of a high school building at Colfax, including heating, ventilation and closets.

Indianapolis, Ind.—Bids are asked by Commissioners of Marion County at Indianapolis until 10 a. m., July 27, for alterations to the county court house.

Peru, Ind.—Bids are asked by Commissioners of Miami County, at Peru, until noon Aug. 17, for the construction of cottage at Lafayette Soldiers' home.

Terre Haute, Ind.—Bids are asked by trustees of Indiana State Normal School Terre Haute, until 9 a. m., Aug. 25, for the construction of a fireproof library building.

Union, Ind.—Bids are asked by Commissioners of Union Township, Parke County, at Hollandsburg, until 10 a. m., Aug. 1, for the construction of a brick school house.

Leavenworth, Kan.—Bids are asked by Board of Education, Robert J. Morgan, Clerk, until Aug. 5, for erection of a school building.

Pittsburg, Kan.—Bids are reported asked by the Regents of the State Normal School, until July 30, for the furnishing of all labor and materials necessary to erect and complete a Manual Training school building. J. H. Hill, President.

Baltimore, Md.—Bids are asked by Board of Awards, until 11 a. m., Aug. 7, for the erection of a public comfort or public convenience station on Center Market space at Baltimore St. E. H. Glidden, Architect, 16 St. Paul St.

Boston, Mass.—Bids are asked by Schoolhouse Commission, until noon, July 29, for building extension to Mechanic Arts Schoolhouse. Certified check for $5,000 required with bid; contract bond for $50,000 required. Bids will also be received at the same time for heating and ventilating, certified check for $2,000 being required for this work.

Fort Brady, Sault Ste. Marie, Mich.—Bids are asked by Lt. Donald W. Strong, Q. M., until 11:30 a. m., July 30, for furnishing all material and installing steam heating in eight sets of quarters.

Jackson, Miss.—Bids are asked by James Knox Taylor, Seupervising Architect, Washington, D. C., until 3 p. m., Aug. 22, for the construction of an addition to, and the remodeling of, the U. S. Post Office and Court House at Jackson, Miss., including plumbing, gas piping, heating apparatus, electric wiring and conduits.

Shelby, N. C.—Bids are asked by County Commissioners, J. F. Roberts, Chairman, until noon, Aug. 6, for labor and materials for building county court house. H. L. Lewman, Architect, 1008 Lincoln Bank Bldg., Louisville, Ky.

Albany, N. Y.—Bids are asked by Milton W. Holt, Deputy State Superintendent of Buildings, The Capitol, until 10 a. m., July 27, for alterations to storm water system, State Hall, Albany, N. Y..

Albany, N. Y.—Bids are asked by Dr. Andrew S. Draper, State Commissioner of Education, Capitol, Albany, until noon, Aug. 15, for the construction of the New York State Normal College, including heating, plumbing, electric work and gas-piping, at Albany. Drawings, etc., with G. L. Heins, State Architect, Capitol, Albany.

New York, N. Y.—Bids are asked by Robert W. Hebberd, Commissioner of Charities, Foot of E. 26th St., until 2:30 p. m., July 29, for furnishing all the labor and materials required for the erection and entire completion of a new male dormitory at the New York City Farm Colony, Borough of Richmond. Surety required is $10,000.

New York, N. Y.—Bids are asked by John F. Ahearn, President Manhattan Borough, until 2 p. m., July 29, for erection of public bath building at 5 Rutgers Pl. Separate bids are asked for the plumbing. Plans, etc., at office of Architects Bernstein & Bernstein, No. 24 East 23d St.

New York, N. Y.—Bids are asked by Robert W. Hebberd, Commissioner of Charities, Foot of East 26th St., until 2:30 p. m., Aug. 5, for all materials and labor required for the complete conduiting electric wiring and all other work in connection with the installation of a complete electric lighting and power system for all the buildings and grounds under the jurisdiction of the Department of Public Charities, and comprising the Metropolitan Hospital District, Blackwell's Island, Borough of Manhattan, the city of New York. Surety required is $20,000. Specifications, etc., at the office of Raymond F. Almirall, Architect, 51 Chambers St.

New York, N. Y.—Bids are asked by Park Board, 5th Ave. and 64th St., until 3 p. m., Aug. 1, for labor and materials for the erection and completion of a soda pavilion in the New York Zoological Park, in Bronx Park, in the city of New York. Security required is $5,000. Plans may be seen at the office of the Department of Parks, Zbrowski Mansion, Claremont Park, The Bronx.

Ravena, N. Y.—Bids are asked by School Board, J. H. Cochran, Secretary, until noon, July 31, for furnishing the necessary labor and materials required in the construction and completion of a school building at Ravena, N. Y. Plans and specifications may be seen at the office of the School Board, J. H. Cochran, Secretary, Ravena, or at the office of Fuller & Pitcher, Architects, 95 State st., Albany, New York.

Columbus, O.—Bids are reported asked by the Board of County Commissioners of Franklin County, until July 29, for labor and material required to build, construct and complete the Franklin County Court House. John Scott, Clerk.

Lakewood, O.—Bids are asked by J. O. Gordon, Clerk of the Board of Education, of Lakewood Village School District, Cuyahoga County, Ohio, at the High School Building, Warren Road, until noon, Aug. 9, for material and labor necessary for the construction of a public school building, to be located east of Ellbur ave., midway between Detroit st. and West Madison ave., also all special work connected therewith, in accordance with the plans and specifications for said buildings and work, on file in the office of L. W. Thomas, Architect, 942 Prospect ave., S. E., Cleveland, O.

Springfield Township, O.—Bids are asked by William Fischvogt, Clerk, Board of Education of Special School District No. 13, Springfield Township, Mt. Healthy, O., R. F. D. No. 4, until noon, Aug. 14, for labor and materials for constructing a school house on Vanzant road, near Hamilton pike, in said district, according to the plans, specifications and profiles on file in the office of the Clerk of the Board of Education of said district and at the office of Martin Fisher, Architect, 2156 Central ave., Cincinnati, O.

Spearfish, S. Dak.—Bids are asked by Regents of Education, state of South Dakota, Sioux Falls, S. Dak., until 9 a. m., Aug. 20, for the completion and equipment of the main building at the Spearfish Normal School, at Spearfish, according to plans and specifications at the office of the President of the Spearfish Normal School, at Spearfish, and office of the Architect, Joseph Schwarz, Sioux Falls.

Houston, Va.—Bids are asked by Building Committee of Halifax County Jail, noon, Aug. 1, for the erection and completion of a new county jail, according to the plans and specifications prepared by Architects Frank P. Milburn & Co., Washington, D. C. Plans, etc., are also on file with Gran Craddock, County Clerk.

Norfolk, Va.—Bids are asked by Bureau Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 30, for the following: Schedule 87—Construction of brick magazine at this navy yard.

Two Rivers, Wis.—Bids are asked by O. M. Maxam, Acting General Superintendent, U. S. Life Saving Service, until 2 p. m., July 29, for the construction of a life saving station at Two Rivers, Wis.

Roads and Streets

Items Arranged Alphabetically by States.

Montgomery, Ala.—Bids are asked by R. S. Williams, City Treasurer, until Aug. 5, for paving sidewalks with hexagon block or Schillinger pavement.

Wilmington, Del.—Bids are asked by Francis A. Price, New Castle, County State Highway Commissioner, until 11 a. m., July 30, for constructing road from Taylor's Bridge to iron bridge across Smyrna River.

Belleville, Ill.—Bids are asked by Board Local Improvements, City Hall, until 2 p. m., July 27, for 80,750 sq. yds. brick paving and 46,900 lin. ft. of curbing; also for 37,943 lin. ft. pipe sewer. Official advertisement will be found in this issue.

Carlinville, Ill.—Bids are asked by David Johnston, City Clerk, until 6 p. m., Aug. 5, for furnishing all material and labor for the construction of such brick street crossings as the city of Carlinville may require during the present fiscal year ending with April 30, 1908.

Freeport, Ill.—Bids are asked by Board Local Improvements, until 2 p. m., July 25, for brick paving of Walnut St. Estimated cost of work is $57,000. G. W. Graham, City Engineer.

Columbus, Ind.—Bids are asked by Commissioners of Bartholomew County until 10 a. m., Aug. 5, for the construction of 7,942 ft. of gravel road in Clefty Township. John M. Davis is County Auditor.

Covington, Ind.—Bids are asked by Commissioners of Park County, at Covington, until Aug. 6, for the construction of five separate gravel roads, aggregating about ten miles in length. Wm. B. Gray is County Auditor.

English, Ind.—Bids are asked by Commissioners of Crawford County, at English, until 2 p. m., Aug. 5, for the construction of roads in Liberty and Whisky Run Townships. Somuel McFall, County Auditor.

Huntington, Ind.—Bids are asked by City Clerk, until 7 p. m., Aug. 13, for construction of vitrified brick pavement and stone curb on South Jefferson St. Bids are also asked for constructing cement sidewalk on Whitelock St. J. B. Vernon, City Civil Engineer.

Indianapolis, Ind.—Bids are asked by Board Public Works, until 10 a. m., July 26, for improvement of a number of streets by grading and paving roadway.

Indianapolis, Ind.—Bids are asked by Board Public Works, until 10 a. m., July 29, for improvement of a number of streets, by grading graveling and rolling roadway, paving sidewalks, etc.

Mount Vernon, Ind.—Bids are asked by Commissioners of Posey County, at Mount Vernon, until noon, Aug. 5, for the construction of ten gravel roads of a total length of 21½ miles.

Peru, Ind.—Bids are asked by County Commissioners, Charles Griswold, County Auditor, until noon, Aug. 7, for the establishment, grading, draining and paving of about 23½ miles of free gravel roads in Richland Township.

Rockville, Ind.—Bids are asked by the Commissioners of Park County until 1 p. m., Aug. 7, for the construction of the following gravel roads: The Crooks & Wimmer road in Union Township, the Punteney and Pence road in Wabash Township, and the Union Chapel road in Washington Township. Work includes grading, draining, straightening, bridging, graveling, etc., the said roads according to plans and specifications on file with H. A. Henderson County Auditor.

Spencer, Ind.—Bids are asked by Commissioners Owen County, until noon, Aug. 6, for the following road work: Continuation of 1 mile and 896 ft. of pike road in Jennings Township; 1 mile and 130 ft. of pike road in Clay Township; 1 mile and 679 ft. of pike road in Taylor Township. Geo. O. Mitten is County Auditor.

Terre Haute, Ind.—Bids are asked by Commissioners of Vigo County, until 11 a. m., Aug. 3, for the improvement by grading and graveling Road No. 2, two miles in length in Prairie Township. J. W. Denehie, County Auditor.

Clinton, Ia.—Bids are asked by H. H. Van Meter, City Clerk, until 8 p. m., July 30, for constructing 1,150 ft. of cement concrete curb on 2d Ave.

Des Moines, Ia.—Bids are asked by Board of Public Works, until 11 a. m., Aug. 7, for the following work: Paving 6th ave., 4,160 sq. yds., vitrified brick pavement; paving north and south alley in block 4, Hall's addition, 1,188 sq. yds., vitrified brick pavement; paving W. 9th st., 12,149 sq. yds. vitrified brick pavement; paving and curbing Arlington ave., 1,320 sq. yds., vitrified brick pavement and 700 lin. ft. of Portland Cement curbing; paving 8th st., 1,363 sq. yds., vitrified brick pavement; paving Forest ave., 19,450 s. yds., vitrified brick pavement.

Greensburg Ky.—Bids are asked by the Green County Turnpike Co., L. W. Coakley, Treasurer, until Aug. 1, for constructing pike about eleven miles in length.

New Orleans, La.—Bids are asked by Chas. R. Kennedy, City Comptroller, until 1 p. m., July 29, for the following work: Paving with bitulithic, Carondelet St., from Upperline to Robert St.; paving with asphalt Carondelet St. from Felicity to Polymnia St.; for sub-surface drains, culverts, curbs and gutter bottoms and sidewalk pavements on Tulane Ave. from Hagan Ave. to Carrollton Ave.; paving with bitulithic Foucher St. from St. Charles Ave. to Coliseum St.; paving with bitulithic Robert St. from Dryades to Prytania St.; paving with asphalt Tulane Ave. from Hagan Ave. to Carrollton Ave.; sub-surface drain, culverts, curbs and gutter bottoms and sidewalk pavements on Teche St. from Opelousas Ave. to Parish line of Jefferson; sub-surface drains, culverts, curbs and gutter bottoms, and sidewalk pavements on Elm St. from Carrollton Ave. to Burdette St.; paving with chert Elm St. from Carrollton Ave to Burdette St.; paving with bitulithic Teche St. from Opelousas Ave. to Parish line of Jefferson; sub-surface drains, culverts, curbs and gutter bottoms and sidewalks on Foucher St. from St. Charles Ave. to Coliseum St.; for sub-surface drains, culverts, curbs and gutter bottoms and sidewalk pavements on Carondelet St. from Felicity to Polymania St.; paving with small granite blocks Ursuline St. from North Peters to Decatur St.; for sub-surface drains, culverts, curbs and gutter bottoms, and sidewalk pavements on Robert St. from Dryades to Prytania St.; for sub-surface drains, culverts, curbs and gutter bottoms and sidewalk pavements on Ursuline St. from N. Peters to Decatur St.; for sub-surface drains, culverts, curbs and gutter bottoms and sidewalk pavements on Carondelet St. from Upperline to Robert Sts., all in accordance with plans and specifications on file in the office of the City Engineer.

Baltimore, Md.—Bids are asked by Board of Awards, until 11 a. m., July 31, to curb, gutter, grade and pave with sheet asphalt, asphalt blocks, vitrified bricks or bitulithic Robert Ave., from Whitelock St. to Druid Hill Park and Lombard St., from Catherine to Wilkens St. Specifications, etc., with Commissioners for Opening Streets, Hoen Bldg.

Frostburg, Md.—Bids are asked by P. Lammert, Town Clerk, until Aug. 1, for grading and paving Maple st.

St. Paul, Minn.—Bids are asked by Board of Public Works, R. L. Gorman, Clerk, until 2 p. m., Aug. 1, for grading portions of Snelling Ave. and Ross St. and for grading a number of alleys.

St. Paul, Minn.—Bids are asked by Board Public Works, R. L. Gorman, Clerk, until 2 p. m., July 29, for the resurfacing of West Seventh st. with asphalt, from Cedar st. to Seven Corners at Fourth st.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., Aug. 1, for repairing brick pavement in portion of 7th St.; also for three contracts for constructing artificial stone curbing, six contracts for constructing brick pavement on alleys, nine contracts for constructing artificial stone sidewalks, and nine contracts for repairing asphalt pavement.

Kansas City, Ma.—Bids are asked by Park Cimmissioners; Frank P. Gossard, Secretary, until 3 p. m., July 29, for grading 39th st., from west line of Kenwood ave. to west line of Holmes st.

Edgewater, N. J.—Bids are asked by Borough Council, until Aug. 6, for an improvement to River Road, in the Shadyside section. Plans and specifications with Watson G. Clark, Borough Engineer, 1125 Broadway, New York city, N. Y.

Newark, N. J.—Bids are asked by Street and Water Commissioners, City Hall, until 3:15 p. m., July 25, for constructing 4,730 sq. ft. of bitulithic pavement on Barbara St.; repairing Cottage St., 1,870 sq. yds. bitulithic; paving Cottage Ave., 11,500 sq. yds. bitulithic pavement; repaving Sussex Ave., 26,600 sq. yds. bituminous concrete pavement on telford foundation.

Plainfield, N. J.—Bids are asked by Geo. B. Wean, City Clerk, until 8 p. m., Aug. 5, for the construction of brick pavement, including: 15,792 sq. yds. brick pavement; 1,035 lin. ft. new curb; 1,400 lin ft. curbing reset; with surface and underdrains and appurtenances. Plans, etc., with Andrew J. Gavett, City Surveyor.

Albany, N. Y.—Bids are asked by Board of Contract and Supply, Isidore Wachsman, Clerk, until 3 p. m., July 29, for improvement of portion of Myrtle Ave. by paving with vitrified blocks. Bond for $2,500 required with bid.

Brooklyn, N. Y.—Bids are asked by Park Board, 5th Ave. and 64th St., New York, until 3 p. m., Aug. 1, for laying cement walks in several parks in Brooklyn; also for laying asphalt tile walk. Security required for each contract is $7,000. Blank forms may be obtained and plans may be seen at the office of the Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn.

Brooklyn, N. Y.—Bids are asked by Bird S. Coler, Borough President, until 11 a. m., July 31, for the work under 11 contracts for street improvements. Largest contract calls for regulating, grading, curbing, sodding parks and laying sidewalks on Ocean Ave., from a point 180 ft. north of Avenue G to Avenue H, and from Avenue I to Kings Highway. The Engineer's estimate of the quantities being as follows: 8,080 lin. ft. of new curbstone, to be set in concrete; 990 cu. yds. of earth excavation; 3,220 cu. yds. of earth filling, to be furnished; 12,960 lin. ft. of concrete curb around parking; 440 cu. yds. of concrete, not to be bid for; 39,710 sq. ft. of cement sidewalk; 5,440 sq. yds. of sod for parking.

Syracuse, N. Y.—Bids are asked by Board of Contract and Supply, George J. Metz, City Clerk, until 1:30 p. m., July 29, for furnishing materials and constructing several stone, cement, asphalt or brick sidewalks.

Celina, O.—Bids are asked by M. Lutz, Engineer, care County Auditor, until 10 a. m., Aug. 10, for the ditching, grading, graveling and macadamizing of the Romer and Jones Road Improvement. Total length is 20,462 ft. and work will be let in one section.

Cleveland, O.—Bids are asked by County Commissioners, Julius C. Dorn, Clerk, until 11 a. m., Aug. 17, for repairing pavement on Wooster pike in Middleburg and Strongsville Townships, in accordance with the form of contract and specifications to be furnished by A. B. Lea, County Engineer.

Cleveland Heights, O.—Bids are asked by William G. Phare, Village Clerk, 204 Amercian Trust Bldg., Cleveland, O., until noon, Aug. 20, for labor and material for constructing sidewalk on Fairmount boulevard. Certified check for $800 required with bid. F. A. Pease Engineering Co., 931 Williamson Bldg., Cleveland, are the engineers.

Cleveland Heights, O.—Bids are asked by W. G. Phare, Village Clerk, 204 American Trust Bldg., Cleveland, until noon, Aug. 20, for material and labor necessary for the improvement of the southly roadway of Fairmount Boulevard from the east line of Coventry Road to the west line of Center Road, by establishing a grade, grading, draining and paving the same with macadam and constructing sidewalks. F. A. Pease, Engineering Co., 931 Williamson Bldg., Cleveland O., are Engineers.

Defiance, O.—Commissioners of Defiance County will let contracts for graveling and grading work in different parts of the county at the following time and place: At Jewell, 9 a. m., July 30, three contracts for graveling, amounting to 2¾ miles; at Defiance, 2 p. m., July 30, three contracts graveling, totaling 1¾ miles; at Sherwood, 9 a. m., July 31, three contracts for regraveling, 1⅜ miles, three contracts for graveling, 3 miles; at Farmer Center, 2:30 p. m., July 31, two contracts for regraveling, 2 miles; one contract for graveling, ¼ mile, and one contract for grading.

Findlay, O.—Bids are asked by Commissioners of Hancock County, at Findlay, until noon, Aug. 10, for the construction of one mile of stone pike between sections 9 and 10, Portage Township, on what is known as the Deming Road.

Lisbon, O.—State Highway Commissioner Huston, Columbus, O., is advertising a highway proposed under the new Ohio law, for letting at Lisbon, Columbiana County, Aug. 10; highway to be of brick construction. Specifications will be mailed to contractors upon request.

McDonald, Pa.—Bids are asked by Dell Allison, Borough Clerk, until 5 p. m., July 29, for grading, curbing and paving Barr St., from creek to borough line, and Washington St., from Lincoln Ave. to creek. Certified check for $100 is required with bid.

Marion, O.—Bids are asked by Commissioners of Marion County, as Board of Turnpike Directors, C. L. Allen, Clerk, until noon, July 27, for resurfacing and making necessary repairs on the following pike roads: Davids and Gooding Pike, Pleasant Township, 2,240 cu. yds. of macadam, estimated cost $2,800.

Davids and Gooding Pike, Pleasant Township, 2,512 cu. yds of gravel, estimated cost $2,261.

Claridon Pike, Claridon Township, 3,167 cu. yds. of macadam, estimated cost $5,402.

Prospect and Waldo Pike, Prospect Township, 4,282 cu. yds. of macadam, estimated cost $6,637.

Napoleon, O.—Bids are asked by F. J. Beck, County Auditor, until 11 a. m., Aug. 6, for the construction of the following road improvements: No. 54, No. 55, No. 56, No. 57 and No. 62. Certified check for $500 required with bid.

Oberlin, O.—Bids are asked by Village Council, C. H. Snyder, Clerk, until noon, July 27, for paving portions of West Lorain and North Professor Sts.

Toledo, O.—Bids are asked by D. T. Davies, Jr., County Auditor, until 10 a. m., Aug. 5, for the repair of Dorr st. stone road No. 34 from the point where said road is intersected by the city line of Toledo, O., and extending thence in a westerly direction to what is known as Reynolds' Corners. Bids are also asked for removing berme on said road.

Toledo, O.—Bids are asked by Board of Public Service, Reynold Voit, Secretary, until noon, July 29, for paving alley between St. Clair and Superior sts., for paving portion of Hawley and Mozart sts.

Struthers, O.—Bids are asked by C. Creed, Village Clerk, until noon, Aug. 10, for labor and materials for laying crosswalks. Bids will also be received at same time for grading Lowellville ave.

Jenkintown, Pa.—Bids are asked by Borough Council, until 7 p. m., July 29, for the resurfacing of 520 lin. ft. of streets, the macadamizing of 2,780 lin. ft. of streets and the laying of 500 lin. ft. of brick or block paving. Plans and specifications can be seen at the office of Ruddach & Mc-

Cracken, Borough Engineers, 401 Leedom St., Jenkintown, Pa.

Monnessen, Pa.—Bids are asked by J. F. Irwin, Borough Engineer, until 6 p. m., Aug. 9, for grading, curbing and paving of approximately 17,500 sq. yds. with vitrified block. The official advertisement will be found elsewhere in this issue.

Sewickley, Pa.—Bids are asked by Frederick T. Martin, Borough Engineers, 514 Broad St., until 4 p. m., Aug. 6, for improvement of Centennial Ave., the work including: 1.70 cu. yds. excavation, 4,830 sq. yds. asphalt block pavement, 100 lin. ft. new curb, 700 lin. ft. curb redressed, 2,630 lin. ft. curb reset.

Washington, Pa.—Bids are asked by County Commissioners, H. R. Campbell, Clerk, until noon, Aug. 6, for construction of improved roadbeds, culverts, etc., upon following roads: Washington and West Middletown road from the end of the present improved road westwardly two miles and 250 ft.; Canonsburg and Westland, two miles; Monongahela to Ginger Hill, or the Dry Run road, three miles; Monongahela city to Donora, two miles; Finleyville toward Library, three and one-fourth miles; Point Lookout road from the Plank road to the end of the Pike at No. 4 dam, ¾ mile. Wm. Wylie, County Road Engineer.

Galveston, Tex.—Bids are asked by John M. Murch, County Auditor, until July 29, for paving Galveston County seawall boulevard, the work including 9,610 sq. yds. of vitrified Thurber brick pavement.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., July 29, for constructing brick pavement on portions of Mitchell St. and Kinnickinnic Ave. Bids are also asked for paving with brick three alleys and portions of Broadway, Market St. and Folsom Pl.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., July 26, for the following street improvement work: Constructing a cement sidewalk, concrete curb and gutter, and cement stairway at the Kinnickinnic River Flushing Tunnel Intake park, at the head of Russell. Certified check for $75 required with bid. Bids are also asked for grading and macadamizing portions of Rogrs St., Mitchell St., 13th Ave., Smith St., Lenox St., 39th St., Concordia Ave. and Scott St., the work including 18,163 cu. yds. grading on Fond du Lac Ave. Bids are also asked for grading and paving a number of alleys.

Fort Mackenzie, Wyo.—Bids are asked by Capt. Wm. D. Davis, Q. M., until 10 a. m., Aug. 5, for construction of cement walks, steps and road crossings at this post.

Sewers.

Items Arranged Alphabetically by States.

Camden, Ark.—Bids are asked by Commissioners of Improvement District No. 2, Louis Bauerlein, Secretary, until noon, Aug. 15, for the construction of 15,000 ft. of sewer. Certified check for $500 required with bid.

Fayetteville, Ark.—Bids are asked by Board of Improvements, until 3 p. m., Aug. 22, for furnishing material and constructing sewer system. Certified check for $1,000 required with bid. Burns & McDonnell, Engineers, 709 Dwight Bldg., Kansas City, Mo.

Hartford, Conn.—Bids are asked by Board of Contract and Supply, City Hall, until 11 a. m., July 29, for construction of Sec. A of Homestead Ave. intercepting sewer system, consisting of about 1,070 lin. ft. of concrete conduit, 10 ft. diameter, and 650 ft. of concrete or brick conduit of egg-shaped section 6x4 ft. in diameter.

Belleville, Ill.—Bids are asked by Board Local Improvements, until 2 p. m., July 27, for contracts aggregating $266,155 and including 37,943 lin. ft. of pipe sewer of various dimensions, 80,750 sq. yds. brick paving and 46,000 lin. ft. of curbing. The official advertisement will be found elsewhere in this page.

Pekin, Ill.—Bids are asked by Board Local Improvement, John R. Seibert, Engineer, until 8 p. m., July 29, for constructing sewer system to include 10,115 lin. ft. 8-in., 12,675 lin. ft. 12-in., 10,485 lin. ft. 15-in., 5,265 lin. ft. 18-in. and 5,105 lin. ft. 20-in. vitrified pipe sewer; 3,495 lin. ft. 18x27-in., 2,320 lin. ft. 20x30-in., 1,555 lin. ft. 22x33-in. (egg-shaped), 720 lin. ft. 24x36-in., 1,205 lin. ft. 26x39-in., 1,595 lin. ft. 28x42-in., 330 lin. ft. 30x45-in., 320 lin. ft. 32x48-in., and 320 lin. ft. 34x51-in. brick sewer (egg shaped); 320 lin. ft. 42-in., 660 lin. ft. 52-in. and 1,594 lin. ft. 62-in. brick sewer (circular). Plans, etc., with City Engineer and at the office of the Consulting Engineer, 803 Great Northern Bldg., Chicago, Ill.

Evansville, Ind.—Bids are asked by Board Public Works, Walter F. Wunderlich, Clerk, until 2 p. m., Aug. 30, for construction of the Kentucky ave. sewer, including the following: 3,850 ft. of reinforced concrete sewer, 8 ft. in diameter; 1,400 ft. of reinforced concrete sewer, 7 ft. 6 ins. in diameter; 1,400 ft. of reinforced concrete sewer, 7 ft. in diameter; 1,220 ft. of reinforced concrete sewer, 6 ft. 6 ins. in diameter; 680 ft. of concrete sewer, 6 ft. in diameter; 1,364 ft. of reinforced concrete sewer, 5 ft. 6 ins. in diameter. Together with manholes, inlets, catch basins, outflow connections for branches and house connections. Bids will be received on egg-shaped brick sewer of above lengths.

Willmar, Minn.—Bids are asked by H. Gunderson, City Clerk, until 8 p. m., Aug. 12, for construction of 2,520 ft. of 12-in. and 1,110 ft. of 18-in. pipe sewers.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., Aug. 1, for the work under two contracts for constructing joint district sewers.

Bloomfield, N. J.—Bids are asked by Wm. L. Johnson, Town Clerk, until 8 p. m., Aug. 1, for grading and constructing storm water sewer in Carteret St., the work including 2,300 cu. yds. excavation, four catch basins, and 225 lin. ft. 20-in. tile pipe. Ernest Baechlin, Town Surveyor.

Cape May, N. J.—Bids are asked by Cape May Real Estate Co., Edmund K. Brown, Resident Engineer, until noon, July 27, for furnishing tools and laying 1,300 lin. ft. of 18-in. T. C. Pipe; 100 lin. ft. of 24-in. T. C. pipe; 100 lin. ft. of 12-in. T. C. pipe; and building 3 manholes and 6 catch basins on Beach Ave. All material for doing above work furnished.

Brooklyn, N. Y.—Bids are asked by Bird S. Coler, Borough President, until 11 a. m., July 31, for furnishing all the labor and materials required for constructing relief sewer in Gold St., from Pierhead Line to Johnson St., and in Johnson St. from Gold St. to Hudson Ave., Section No. 1, Division No. 2, Gold St. system. Security required is $175,000 and work includes: Outlet Section A, 173 lin. ft.; outlet Section B, 40 lin. ft.; connecting chamber, 80 lin. ft.; 162-in. circular sewer, 1,910 lin. ft.; 156-in. circular sewer, 1,431 lin. ft.; 150-in. circular sewer, 928 lin. ft.; 24-in. pipe sewer, 150 lin. ft.; 18-in. pipe sewer, 730 lin. ft.; 15-in. pipe sewer, 2,190 lin. ft.; 12-in. pipe sewer, 4,645 lin. ft., etc.

New York, N. Y.—Bids are asked by George Cromwell, President Richmond Borough, St. George, New Brighton, until noon, July 30, for constructing temporary sanitary sewer in Newark Ave., the security required being $4,000. Bids are also asked for constructing sewer in Jay St., the security required in this case being $14,000.

Wahpeton, N. Dak.—Bids are asked by Wm. R. Purdon, City Auditor, until 8 p. m., July 27, for construction of sewers in Dakota ave., the work including the following: 776 lin. ft. 24-in. vitrified pipe; 720 lin. ft. 20-in. vitrified pipe; 720 ft. 18-in. vitrified pipe; 360 lin. ft. 15-in. vitrified pipe. Samuel F. Crabbe, Engineer, Fargo, N. Dak.

Cleveland Heights, O.—Bids are asked by William G. Phare, Village Clerk, 204 American Trust Bldg., Cleveland, O., until noon, Aug. 20, for constructing sewers in Fairmount boulevard, from Coventry Road to Center Road. F. A. Pease Engineering Co., 931 Williamson Bldg., Cleveland, O., are the engineers.

Napoleon, O.—Bids are asked by F. W. Hilgendorff, Village Clerk, until noon, Jully 30, for constructing 600 ft. of 8-in. vitrified salt-glazed pipe sewer.

Port Clinton, O.—Bids are asked by J. J. Huber, Village Clerk, until noon, Aug. 19, for labor and materials for constructing sewer in Sewer District No. 9. Certified check for $200 required with bid.

Youngstown, O.—Bids are asked by Board Public Service, W. H. McMillan, Clerk, until noon, Aug. 2, for constructing district sewer, in Elm St., Parkview, Bryson, Baldwin, Wick, Linden, Andrews to Crab Creek.

McKeesport, Pa.—Bids are asked by C. E. Soles, City Controller, until 4 p. m., Aug. 6, for removing all dirt, etc., from outlets to sewers along river front. Bond of $1,000 required with bid.

Scottdale, Pa.—Bids are asked by A. L. Porter, Borough Secretary, until 8 p. m., Aug. 1, for constructing sewer system to consist of about 2¼ miles of 8 to 36 in. sewers. J. G. Hogg, Connellsville, Pa., is Engineer.

Newport, R. I.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 30, for extending sewer at naval station at Newport. Applications for bidding blanks should refer to Schedule 101.

Marshfield, Wis.—Bids are asked by M. G. Fleckenstein, City Clerk, until noon, Aug. 12, for constructing sewer on Sixth st.

Fond du Lac, Wis.—Bids are reported asked by City Clerk, until 2 p. m., July 27, for constructing storm sewer in Johnson St., Main St., Amory and Follett Sts., and a sanitary sewer in Doty, Main and Arndt Sts.

Milwaukee, Wis.—Bids are asked by Board Public Works, until 10:30 a. m., July 30, for constructing pipe sewers in portions of College Ave., South Pierce St., Lincoln Ave., Greenfield Ave., 4th Ave., and Superior St.

North Milwaukee, Wis.—Plans and specifications for sewers to be let by this city on Aug. 5 are on file at office of Engineering-Contracting, 355 Dearborn St. Chicago, Ill. The official advertisement will be found elsewhere in this issue.

Water Supply

Items Arranged Alphabetically by States.

Russellville, Ark.—Bids are asked by Water Commissioners, until 8 p. m., Aug. 20, for labor and material for the constructoin of a complete water-works system. For further particulars address M. A. Earl & Co., Consulting Engineer, Muskogee, I. T.

Boone, Ia.—Bids are asked by Otto Hile, City Clerk, until 8 p. m., July 29, for the work of drilling and constructing well No. 3 in the Fair Grounds addition. Well is to be 300 ft. deep. K. C. Kastberg, City Engineer.

Thayer, Ill.—Bids are asked by the Village Clerk until Aug. 5, for the digging and laying of 4-in. pipe with hydrants and five 10-ft. spurs.

Belle Plaine, Minn.—Bids are asked by this village, until 8 p. m., Aug. 12, for a complete waterworks system. The work will comprise a steel tower and steel tank, distribution pipe line system, geared deep well gasoline engine and pump and brick building. Oscar Claussen, 514 German Am. Bank Bldg., St. Paul, Minn., is Consulting Engineer.

Jamestown, N. Y.—Plans and specifications for laying 12,000 ft. of 16 in. and 750 ft. of 12 in. water mains for this city are on file at office of Enginering-Contracting, 355 Dearborn St., Chicago, Ill. Bids for the work are asked until Aug. 1, as is stated in the official advertisement elsewhere in this issue.

Chewelah, Wash.—Bids are asked by Town Clerk until Aug. 1, for constructing waterworks and electric light plant.

Withee, Wis.—Bids are asked by Marius Andersen, Village Clerk, until 7:30 p. m., Aug. 2, for the furnishing of 2,600 ft. of 6 to 8 in. cast iron pipe, 7 hydrants, three 6 in. valves, the work of laying the above amount of pipe and the erection of a 30,000 gallon steel tank and tower. For additional information apply to C. H. Phillips, Marshfield, Wis.

Excavation—Earth and Rock

Items Arranged Alphabetically by States.

Washington, D. C.—Dredging—Bids are asked by Maj. Spencer Cosby, U. S. Engineer Office, 22d and K sts., N. W., Washington, D. C., until noon, Aug. 12, for dredging in Potomac and Anacostia Rivers, near Washington, D. C.

Wilmington, Del.—Dredging—Bids are asked by Maj. C. A. F. Flagler, U. S. Engrs., until 11 a. m., Aug. 5, for dredging Salem River, N. J.

Tampa, Fla.—Dredging—Bids are asked by Major Francis R. Shunk, U. S. Engrs. Office, Jacksonville, Fla., until noon, Aug. 16, for dredging in Tampa Bay, Florida.

Brunswick, Ga.—Dredging — Bids are asked by Lt. Col. Dan. C. Kingman, U. S. Engrs., Savannah, Ga., until noon, Aug. 22, for dredging in inner and outer harbor at Brunswick, Ga.

Hooppole, Ill.—Ditch Work.—Bids are asked by Drainage Commissioners, until 2 p. m., Aug. 2, for deepening and widening of main ditch, requiring the removal of approximately 150,000 cu. yds. of material. F. W. Sears, Engineer, Prophetstown, Ill.

Piper City, Ill.—Ditch Work.—Bids are asked by Commissioners of Vermilion Special Drainage District, D. W. Turney, until 1 p. m., July 31, for 44,450 cu. yds. of dredge or machine ditch work and 62,460 cu. yds. of scraper ditch work.

Sullivan, Ind.—Ditch Work.—Bids are asked by W. H. Jones, Jr., Superintendent of Construction, New Lebanon, Ind., until Aug. 5, for constructing a ditch requiring about 80,000 cu. yds. excavation. Dredge boat can be used on work.

Cheboygan, Mich.—Dredging—Bids are asked by Col. Chas. E. L. B. Davis, U. S. Engrs., until 3 p. m., Aug. 15, for dredging harbor at Cheboygan.

Portsmouth, N. H.—Filling—Bids are asked by Bureau of Yards and Docks, Navy Department, Washington, until 11 a. m., Aug. 10, for filling in back of quay wall, navy yard, Portsmouth, N. H.

New York, N. Y.—Grading.—Bids are asked by Park Board, 5th Ave. and 64th St., until 3 p. m., Aug. 1, for furnishing all the materials and labor for grading and improving ground north of the Municipal building in Crotona Park, in the city of New York. Security required is $10,000. Blank forms may be obtained and plans may be seen at the office of the Department of Parks, Zbrowski Mansion, Claremont Park, Borough of The Bronx.

Philadelphia, Pa.—Dredging—Bids are asked by Major J. C. Sanford, U. S. Engineer Office, 815 Witherspoon Bldg., Philadelphia, Pa., until noon, Aug. 12, for dredging in Delaware River at Perriwig Bar.

Miscellaneous

Items Arranged Alphabetically by States.

Washington, D. C.—Steam vessel—Bids are asked by Light-House Board, Washington, D. C., until 2 p. m., Aug. 19, for the construction of a single-screw steel steam light-vessel, to be delivered either at Charlevoix, Mich.; Detroit, Mich., or Tompkinsville, N. Y.

Mount Vernon, Ind.—Concrete Dam—Bids are asked by Commissioners of Posey County, at Mount Vernon, until 2 p. m., Aug. 6, for the construction of a concrete dam.

New Orleans, La.—Track Work.—Bids are asked by Chas. R. Kennedy, City Comptroller, until 1 p. m., July 29, for the construction of standard gauge railroad track for the city of New Orleans for Public Belt Railroad purposes.

Boston, Mass.—Conduit.—Bids are asked by Charles River Basin Commission, 367 Boylston St., Boston, Mass., until 2:30 p. m., Aug. 5, for building a portion of the Cambridge Marginal Conduit. This work will require approximately 2,000 cu. yds. of concrete masonry, 40,000 lin. ft. of piles, and the excavation and refill of about 1,900 lin. ft. of trench.

Fort Omaha, Neb.—Gas House, Etc.—Bids are asked by Major Thomas Cruse, Q. M., Army Bldg., Omaha, Neb., until 11 a. m., Aug. 8, for constructing a balloon house, a hydrogen gas house and a wireless telegraph station at Fort Omaha, Neb.

Somers Point, N. J.—Wharf, Grading.—Bids are asked by James E. Scull, City Clerk, until 8 p. m., Aug. 5, for grading and graveling Harbor Lane and building a bulkhead or wharf on Harbor Lane, in the city of Somers Point. Security bond for $2,000 will be required.

Brooklyn, N. Y.—Refuse Disposal.—Bids are asked by W. Bensel, Commissioner of Street Cleaning, 13 Park Row, New York, until noon, Aug. 1, for furnishing all the labor and materials required for the final disposition of all ashes, street sweeping and rubbish. The work is divided into two contracts and surety required for each will be $100,000. The period of the contract will be for five years, beginning with Oct. 28, 1907.

New York, N. Y.—Chimney, Etc.—Bids are asked by John V. Coggey, Commissioner of Correction, 148 E. 20th St., until 11 a. m., July 30, for furnishing all labor and material required for the erection and completion of an extension to the present boiler house, including a new chimney and underground chimney connections and the installation of three (3) new boilers, 250 H. P. each, at Hart's Island, N. Y.

New York, N. Y.—Greenhouse.—Bids are asked by Park Board, until 3 p. m., Aug. 1, for furnishing all the labor and materials for completely erecting and constructing a greenhouse in the Botanic Garden in Bronx Park. Security required is $17,000. Plans may be seen and blank forms may be obtained at the office of the Department of Parks, Zbroski Mansion, Claremont Park, Borough of The Bronx.

Lebanon, Pa.—Street Lighting.—Bids are asked by Police Committee, Geo. D. Krause, Chairman, until noon, Aug. 31, for street lighting with electric lights. Each proposal for arc electric and incandescent electric lights must be accompanied by a proposal bond, or certified check, in the sum of $1,000,000.

Fort Adams, R. I.—Wire Fence—Bids are asked by Capt. Willis Metcalf, Constructing Q. M., until 3 p. m., Aug. 5, for furnishing and placing wire fence around U. S. reservation near Saunderstown, R. I.

Galveston, Tex.—Jetty Work—Bids are asked by Capt. John C. Oakes, U. S. Engrs., Galveston, until noon, Aug. 16, for jetty work at mouth of Brazos River, Texas.

Bremerton, Wash.—Concrete Quay Wall—Bids are asked by Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a. m., Aug. 24, for constructing a concrete quay wall at the Puget Sound navy yard, Bremerton, Wash.

Materials, Machines, Supplies, Tools, Etc

Items Arranged Alphabetically by States.

Mare Island, Cal.—Wire, Steel—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 6, to furnish at the navy yard, Mare Island, Cal., and the naval training station, San Francisco, California, as specified, a quantity of naval supplies, as follows: Schedule 89—Electrical wire, rubber sockets. Schedule 90—Corrugated sheet steel.

Washington, D. C.—Rails, Ties, Piles, etc.—Bids are asked by D. W. Ross, Purchasing Officer, Isthmian Canal Commissioner, until 10:30 a. m., Aug. 8, for furnishing under canal circular 378, steel rails, splice bars, track bolts and spikes, nut locks, frogs, switch fixtures, car replacers, cross ties, piles, lumber, vitrified culvert pipe, etc.

Washington, D. C.—Radiators—Bids are asked by Elliott Woods, Superintendent U. S. Capitol Building and Grounds, until noon, July 31, for furnishing and delivering, only, direct radiators for hot water heating for the Office Building, House of Representatives.

Washington, D. C.—Dump Cars—Bids are asked by D. W. Ross, General Purchasing Officer, Isthmian Canal Commission, until 10:30 a. m., Aug. 2, for furnishing dump cars under canal circular 377.

Washington, D. C.—Cable, Paving Blocks, etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 30, to furnish at the navy yard, Washington, D. C., a quantity of naval supplies, as follows: Schedule 99—Electrical cable, curb stone machine, asphalt paving blocks. Schedule 102—Steel balls, steel grease cups, brass tubing. Schedule 106—Blueprint paper. Schedule 111—Tool steel.

Pensacola, Fla.—Ties, Electrical Supplies, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 30, to furnish at the navy yard, Pensacola, Fla., a quantity of naval supplies, as follows: Schedule 96—Creosoted ties. Schedule 97—Electrical supplies, vulcanized rubber, etc., mica. Schedule 98—Steel rivets, bolts and nuts, packing.

Chicago, Ill.—Crushed Limestone.—Bids are asked by Department Public Works, until 11 a. m., July 30, for furnishing and delivering to the city of Chicago at various designated points in the city of Chicago, approximately 15,000 cu. yds. of crushed limestone according to plans and specifications on file in the office of the Department of Public Works., Room 223 City Hall.

Chicago, Ill.—*Machinery*—Bids are asked by Business Manager Board of Education, Tribune Bldg., until noon, Aug. 16, for machinery for woodworking, machine shops, forgeroom, foundry, etc., Lyman Trumbull manual training high school.

Boston, Mass.—Air Hose, Pipe, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 30, to furnish at the navy yard, Boston, Mass., a quantity of naval supplies, among which are the following: Schedule 106—Air hose. Schedule 107—Bar steel. Schedule 109—Brass bolts, steel bolts and nuts, eyebolts, hose clamps, files, screws, hardware and tools. Schedule 111—Phosphor and rolled bronze, sheet copper and iron, silver and wiping solder, bar steel. Schedule 114—Iron pipe, cocks, valves. Schedule 115—Blueprint paper, etc.

New Orleans, La.—Locomotives.—Bids are asked by Chas. R. Kennedy, City Comptroller, until 1 p. m., July 29, for a switching locomotive or locomotives for the city of New Orleans for Public Belt Railroad purposes.

St. Paul, Minn.—Street Signs.—Bids are asked by George T. Redington, City Clerk, until 2 p. m., Aug. 1, for furnishing enamel iron street signs, in accordance with specifications on file in the office of the Commissioner of Public Works.

Newark, N. J.—Street Sweeping Machines.—Bids are asked by Street and Water Commissioners, City Hall, until 3:30 p. m., July 25, for furnishing five two-horse steel frame street ,sweeping machines.

New York, N. Y.—Pipe, Pump, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 30, to furnish at the navy yard, New York, N. Y., a quantity of naval supplies, among which are the following: Schedule 102—Iron doors, ventilators, etc., copper gutter, rails, spikes, etc., steel trusses, cast-iron pipe and specials, hydrants. Schedule 103—Electrical conduit, wire, and supplies, electric light posts, brick, Portland cement, lime, sand, roofing material, lumber, ties. Schedule 105—Boiler, feed pump, windlass. Schedule 106—Air hose, galvanized pipe. Schedule 108—Railroad track, dump cars.—Schedule 109—Bits, paint cans. Schedule 110—Oak. Schedule 113—Japan drier, ferric oxide varnish, marine glue, rosin. Schedule 114—Copper and lead pipe, valves. Schedule 115—Blueprint and drawing paper, steel tapes, dry plates, developing paper, drawing instruments, etc.

New York, N. Y.—Ice-Making Plant—Bids are asked by Wm. S. Patten, Q. M., 39 Whitehall st., until 1 p. m., July 31, for furnishing and delivering alongside of vessel within reach of ship's tackle, in the harbor of New York, a complete ice--making and distilling plant.

New York, N. Y.—Broken Stone.—Bids are asked by Park Board, until 3 p. m., Aug. 1, for furnishing and delivering 2,000 cu. yds. broken stone or trap rock and 2,000 cu. yds. screenings for trap rock (No. 3, 1907), for park, Borough of The Bronx. Blank forms may be obtained at the office of the Department of Parks, Zebrowski Mansion, Claremont Park, The Bronx.

New York, N. Y.—Boilers, Laundry Machinery.—Bids are asked by Board of Health, 55th St. and 6th Ave., until 9:45 a. m., July 30, for furnishing all the labor and materials necessary or required to furnish and install two tubular boilers, laundry machinery and equipment, together with all necessary steamfitting and other work incidental thereto in the laundry building on the grounds of the Tuberculosis Sanitorium at Otisville, Orange County, New York.

New York, N. Y.—Trap Rock.—Bids are asked by Louis F. Haffen, President Bronx Borough, 177th St. and 3d Ave., until 11 a. m., July 30, for furnishing and delivering broken trap rock, lime or native stone screenings to the Bureau of Highways, as follows: 15,000 cu. yds. best quality 1½-in. broken stone, trap rock, lime or native stone. 5,000 cu. yds. best quality ½-in. screenings, trap rock, lime or native stone.

Norwood, O.—Water Meters.—Bids are asked by Board Public Service, L. H. Gebhart, Clerk, until noon, Aug. 3, for furnishing and delivering 500 ⅝-in. water meters and connections, to be delivered in quantities of 100 or more as ordered.

Youngstown, O.—Fire Hydrants—Bids are asked by Board Public Service, W. H. McMillan, Clerk, until July 26, for furnishing 40 fire hydrants.

Williamsport, Pa.—Paving Machinery.—Bids are asked by J. J. Galbraith, City Clerk, until noon, Aug. 3, for the furnishing, delivered at Williamsport, Pa., the following: One 20-HP. boiler, including fittings; one 15-HP. engine, including fittings; one steam jacketed asphalt mixer; one fire wagon, to heat asphalt tools; one portable asphalt melting kettle; one sand drier, one 7 or 8-ton tandem asphalt road roller. James F. Fisher, City Engineer.

Millvale (P. O. Sta. Allegheny), Pa.—Fire Hose.—Bids are asked by H. H. Dickson, Clerk, 401 Grant Ave., until 3 p. m., Aug. 6, for furnishing 1,000 ft. of fire hose.

Charleston, S. C.—Motor Drive Outfits.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., July 30, to furnish at the navy yard, Charleston, S. C., a quantity of naval supplies, as follows: Schedule 104—Motor drive outfits. Schedule 105—Fuel oil forges.

Puget Sound, Wash.—Pipe, Cement, Chain, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 6, to furnish at the navy yard, Puget Sound, Wash., a quantity of naval supplies, as follows: Schedule 88—Submarine telegraph cable, Portland cement, fir, cast-iron pipe and specials, wrought-iron pipe, valves, hydrants. Schedule 89—Annunciators, searchlight mirror. Schedule 91—Pig and Norway iron, bar steel, steel floor plates. Schedule 92—Hardware, iron chain.

Wheeling, W. Va.—Iron and Steel.—Bids are asked by Capt. F. C. Boggs, U. S. Engrs., until 11 a. m., Aug. 14, for furnishing and delivering iron and steel for beartrap gates for dam No. 18, Ohio River.

CONTRACTS LET.

Items Arranged Alphabetically by States.

Cuyahoga Falls, O.—Paving.—John J. O'Neil, Akron, O., has been awarded contract for paving South Front St. with Malvern blocks at $18,537.

Cleveland, O.—Grade Crossing Removal.—Contract for abolition of Kinsman Road crossing of Pennsylvania R. R. has been let to Carland & Hecker at $68,220.

Mansfield, O.—Road Work.—Contract for construction of about three miles of pike road in Madison and Franklin Townships has been let to D. R. McArthur & Co., Kenton, O., at $15,200.

Mount Vernon, O.—Paving—Contract for constructing 4-in. asphalt block, gravel base with a concrete curb and gutter on East High St. is stated to have been let to Evans & Harper, Zanesville, O., at $48,974.

McKeesport, Pa.—Bridge.—McKeesport & Port Vue Bridge Co. has awarded contract to Dravo Construction Co., Pittsburg, Pa., for the erection of a steel arch bridge across the Baltimore & Ohio tracks at 15th Ave. and Walnut St. It will cost $150,000.

Sharon, Pa.—Bridge.—County Commissioners have awarded contract for the new "V" bridge in Sharon, across the Shenango River, to the Canton Bridge Co., of Canton, O. McIntyre & Sons got the contract for the stone work. The entire cost of the bridge will be about $75,000.

Chattanooga, Tenn.—Tunnel.—T. J. Shea, New Orleans, La., has been awarded contract for constructing tunnel through Missionary Ridge for use as a public highway. The tunnel will be 700 ft. long and 32 ft. high by 32 ft. wide. The contract price is $122,423.

Bryan, Tex.—Iron Bridge.—Commissioners' Court has awarded the contract for building the iron bridge across the Brazos River at Koppe's Ferry to the Missouri Valley Bridge Co. of Kansas City. The contract price is $17,190 and the bridge is to be completed within eight months.

Dallas, Tex.—Road Work.—Contract for constructing Intermediate Road has been let to Lauder Bros. at $4,656.

Richmond, Va.—Railroad Work.—Winston & Co., Richmond, have been awarded the contract for building ten miles of the Virginia Air Line Railroad, beginning with the bridge over the Rivanna River on to Upper Bremo, in Fluvanna County. This work takes in the heaviest construction on the road and work will be begun at once.

Fairmont, W. Va.—Electric Railway.—Contract for the construction of the Fairmont & Mannington electric railway, 15 miles in length and connecting two of the largest towns in the interior of the state, was today let to the Blodget Construction Co. of Wheeling, W. Va. The construction will cost about $400,000.

Grafton, W. Va.—Railroad Work.—The contract for the construction of the Buckhannon & Northern R. R., from Morgantown to the Pennsylvania line, is stated to have been let to the Brady Engineering & Construction Co. of Parkersburg, W. Va. The active work of grading and laying the track will begin about Sept. 1, it is said.

Tacoma, Wash.—Sewer.—N. A. Jones, at $16,485, has been awarded contract for constructing sewer in District No. 164.

Fond du Lac, Wis.—Storm Sewer.—S. H. Cole has been awarded contract for construction of 8th St. storm sewer at $14,426.

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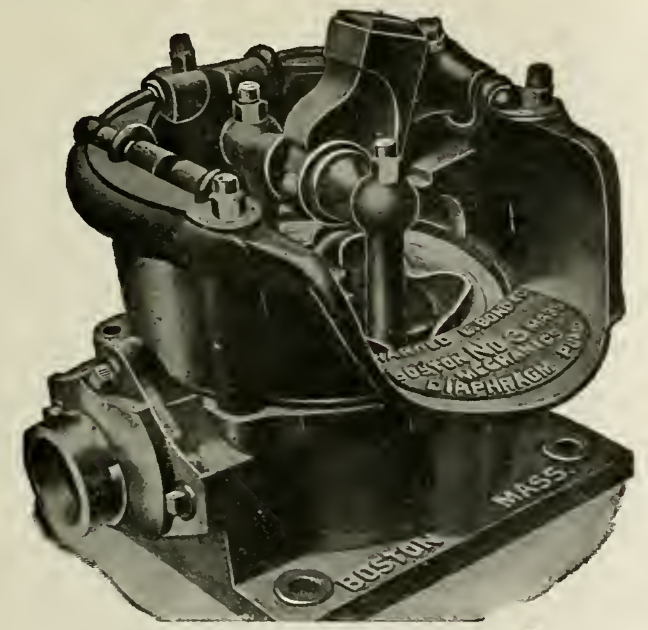
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VIADUCT.

East St. Louis, Ill.

Sealed proposals suitably endorsed on envelope will be received at the office of the Board of Local Improvements of the City of East St. Louis, Illinois, until 12 o'clock M., August 1st, 1907, for the rebuilding of the Broadway Viaduct in this city, according to the plans and specifications on file at the City Engineer's office. All proposals shall be made on blanks which shall be furnished at the office of the City Engineer. Each bidder shall deposit with his bid a certified check of $1,000.00, payable to the order of the President of the Board of Local Improvements of the City of East St. Louis, Illinois, to guarantee that the successful bidder will, within ten days, enter into a contract with the city, and within twenty days from the signing of the contract will execute a collateral or other bond to be approved, for the faithful performance of the contract in accordance with the plans and specifications.

Further information may be obtained at the office of W. J. Crocken, City Engineer, or at the office of Carl Gaylor, C. E., 900 Wainwright Building, St. Louis, Mo.

The city especially reserves the right to reject any or all bids.

W. J. CROCKEN,
3-2t City Engineer.

BRICK PAVING.

Monessen, Pa.

Notice is hereby given, by order of the Streets and Roads Committee of the Borough of Monessen, Pennsylvania, sealed proposals will be received at the office of the Borough Engineer until 6:00 P. M., August 9th, 1907, for the grading, curbing and paving of approximately, 17,500 square yards of paving with vitrified block. Plans and specifications are on file in the office of the Borough Engineer.

Each bid must be accompanied by a certified check for $500.00, which will be returned to the successful bidder on execution of the contract; or forfeited if he should fail to enter into and execute the contract awarded him, in which case, Council may accept any other bid.

All other checks will be retained until the contract is signed, when they will be returned. The right is reserved to reject any or all bids.

W. A. MILLER,
Chairman St. & Roads Com
J. F. IRWIN,
4-3t Borough Engineer.

WATER MAINS.

Jamestown, N. Y.
Bids Opened August 1, 1907.

Proposals are hereby solicited for the furnishing of material and performance of work in the laying of a water main, of approximately 12,000 feet of 16 inch pipe and 750 feet of 12 inch pipe, in the City of Jamestown, for said city. The work is divided into three classes (1) the furnishing of all pipe and specials, (2) hauling of the materials from the railroad switch and delivering of same along line of trenching, (3) digging of trench, laying of pipe and back filling.

Complete plans and specifications for the performance of each class of work are on file with the Water Department of the City of Jamestown, at its office in the City Hall, in said city, and will be furnished upon application, to prospective bidders. Specifications may also be seen at the office of ENGINEERING-CONTRACTING, 355 Dearborn St., Chicago.

Sealed proposals for the performance of any class will be received by the Board of Water Commissioners at its office aforesaid, until the hour of 12 o'clock, noon, of the 1st day of August, 1907, at which time all bids will be opened. The Board reserves to itself the right to reject any and all bids. A certified check of five per cent of the estimated gross amount of the bid must accompany the same, upon the terms and conditions specified in the proposal sheet.

Dated the 10th day of July, 1907.

BOARD OF WATER COMMISSIONERS,
By Clement B. Jones,
3-2t Secretary.

PROPOSAL FOR SEWERS.

North Milwaukee, Wis.

Sealed proposals will be received by Emil Klamp, Village Clerk, North Milwaukee, until August 5, 1907, at 7:30 p. m., for the construction of approximately 1,343 ft. of 6″, 8,100 ft. of 8″, 4,300 ft. of 10″ and 200 ft. of 12″ vitrified pipe sewers and 43 manholes. Each bid must be accompanied by a certified check for 5 per cent of the approximate amount of the bid. Plans and specifications will be on file after July 20 at the village hall, North Milwaukee, 31 Vroman Building, Madison, Wis., at the Builders' and Traders' Exchange, Milwaukee, Wis., and at the office of Engineering-Contracting, 355 Dearborn St., Chicago, Ill.

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3-2t Village Clerk.

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PAVING AND SEWERS.

Belleville, Ill.

A letting of sewer and paving contracts will take place in the City Hall in the City of Belleville, Illinois, at two o'clock, P. M., on July 27th, 1907. Contracts will be awarded for 80,750 square yards of brick paving for 46,900 lineal feet of curbing and 37,943 lineal feet of sewer pipe of various dimensions. The estimated cost of the improvements in the aggregate is $266,115.00.

BOARD OF LOCAL IMPROVEMENTS,
4-1t Belleville, Ill.

COURT HOUSE.

Bakersville, N. C.

Notice is hereby given that the undersigned will receive until 10 o'clock a. m., on August 15th, 1907, sealed proposals for the furnishing of materials and performing the labor required for the building of a Court House at Bakersville, North Carolina, according to the plans and specifications which have been adopted, and are on file, and open to inspection, at the office of J. D. Braswell, Clerk.

All bids are to be delivered, sealed, to the Commissioners on or before the time named.

A certified check for 10 per cent of the total amount of the bid, payable to Jos. Bowditch, Chairman, must accompany each bid, such check to be forfeited to the county should the contract be awarded to the bidder and he fail within 30 days, after being notified, to execute a Surety Company Bond for the faithful performance of the contract based on his bid; such bond to be for double the contract price.

These bids shall be made out on the regular proposal blank, and no bids will be considered that are submitted in any other way than on the printed sheet, which must be without interlineations or changes. These bids will be received on the several systems, and items of construction, named in the specifications and proposals; however, the right is reserved by the Commissioners, to adopt the system of construction, and bid on that system, which they may decide to be to the best advantage of the County.

Bidders shall set forth in their proposal the number of buildings of this character erected by them, the cost of such buildings and their locations, as well as such other information as will establish the bidders' experience and qualifications.

The Contractors, to whom this work shall be awarded, must furnish evidence that he is skilled and experienced in fireproof floor construction. Favorable consideration will be given the bid of contractors so experienced and qualified.

The bidder must satisfy the Commissioners of his ability to furnish the materials and perform the work for which he bids.

The contract shall be let only as a whole; bids in detail will not be given consideration as it is the purpose of the Commissioners to hold one Contractor, or firm, responsible for the entire accepted work according to these specifications.

As a precaution against loss of time, each bidder should furnish with his bid, a letter from a Surety Company, stating that they will make, for the bidder, the requisite bond, guaranteeing the completion of the contract.

The contract price shall be paid and percentage shall be retained as provided for in the specifications.

The Surety Company Bond shall be on a bond blank similar to No. 203 G. of the Fidelity and Deposit Co., of Maryland.

The right is hereby reserved to reject any and all bids, or to waive defects in the same, if it be deemed in the interest of the County to do so.

Plans are also on file in the office of the Architect, H. L. Lewman, 1008 Lincoln Bank Building, Louisville, Ky.

JOSEPH BOWDITCH,
3-2t Chairman.

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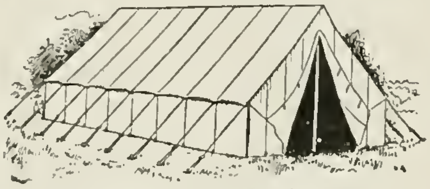

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CIVIL SERVICE EXAMINATIONS will be held at room 400, City Hall, Chicago, as follows: Mechanical and Electrical Engineers, grade 4, salary $1200 to $1400, July 22. Spelling, Penmanship, Arithmetic, Technical Knowledge and Experience. Open to residents of Chicago only. Mechanical Engineers, Board of Education, grade 10, salary $3000 or more, Sept. 28. Spelling, Penmanship, Arithmetic, Technical Knowledge and Experience. Residents of Chicago only. Architectural Draftsmen. Open to residents and non-residents of Chicago: Grade 5, salary $1400 to $1600, Oct. 1; grade 6 salary $1600 to $1800, Oct. 15; grade 4, salary $1200 to $1400, Oct. 30.

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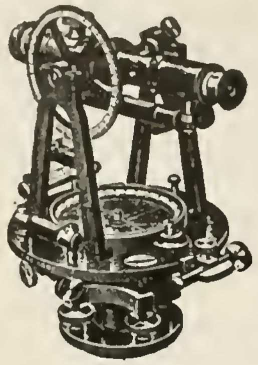
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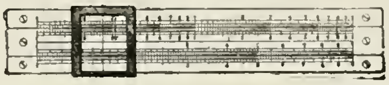
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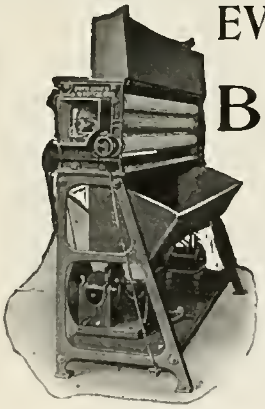
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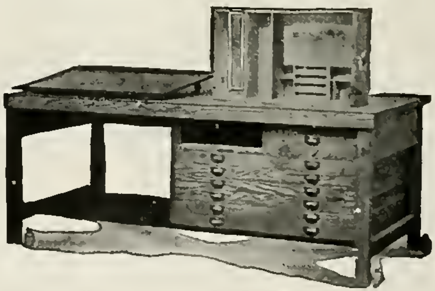
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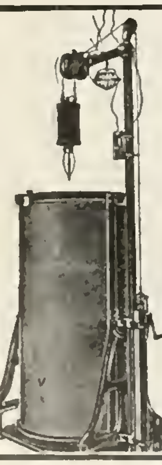
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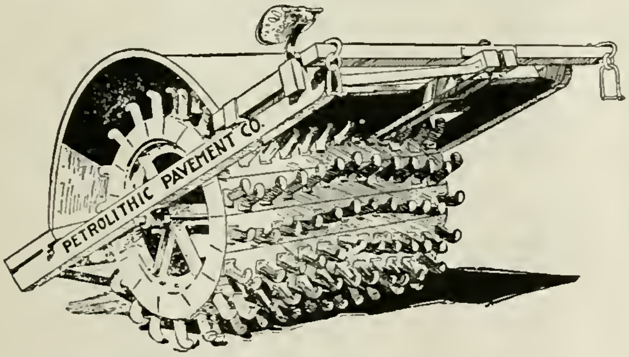
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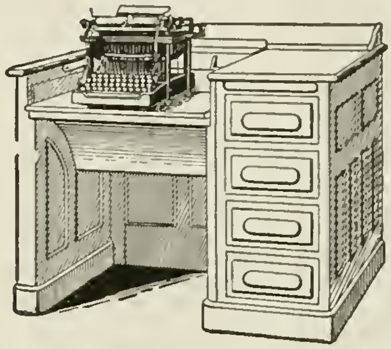

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Chemical Engineers Organize.

The multiplication of engineering societies has both good and had features. The good features are obvious to any thinking person and the bad features can for the greater part be laid to the fact that duplication of both object and membership exists. In the field of municipal engineering, using the term in its wide meaning, there are, for instance, several societies all organized with practically the same objects in mind and each in a large measure a duplicate in membership of the others. This is a circumstance that we could wish to see changed, and it is no argument against this wish to affirm that these several societies are each moderately prosperous and each doing moderately good work. The same membership could by concentrating its labor and combining its expenditure toward the support of one society accomplish more and better work. We make these remarks so boldly in prefacing our announcement here of the proposed organization of an American Society of Chemical Engineers because we feel that their strictures in no way apply to the new organization. There is now no society of chemical engineers and there is a large number of such engineers with common interests and common lines of thought available for the formation of such a society. Its opportunities for doing good work if formed would seem to be numerous. Altogether, therefore, and though we speak as laymen, we heartily welcome the news that on June 21 at Atlantic City, N. J., steps were taken by a number of well-known chemical engineers toward the organization of a national society of the members of their profession. We trust that the committee appointed at Atlantic City to formulate plans and interest chemical engineers in their object will have a full measure of success in their work.

Tests of Reinforced Concrete

We give a large amount of space in this issue to a summary of the results of a number of tests made on reinforced concrete beams at the laboratories of the University of Wisconsin. While much of this information has already been made available in papers and articles scattered over a considerable period of time and through numerous papers before engineering societies and in the technical press, we believe that its summary in one place will be welcome to our readers even though it involves repeating a portion of matter already published. The tests cover a wide range of determinations and while all of them are important and deserve attention we think that we are justified in saying that the really unique work of the Wisconsin University students and professors lies in the series of tests which disproved the idea promulgated by Mr. Considere, the French expert, that the stretch of concrete reinforced with steel was materially greater than that of plain concrete. While this idea, when originally put forth, came as a shock to those brought up in the traditions of the behavior of materials under stress, it was quite generally accepted. The talented French investigator's tests seem unassailable and concrete reinforced with steel was put well in the way of being classed as an abnormal material in its action under tensile stress. The Wisconsin University tests were the first definite and reliable indications to the contrary. Since those tests were first published other investigators have discredited the conclusions of Considiere and now, in America at least, it is generally accepted that concrete reinforced with steel stretches no more under tension without rupture than does plain concrete. In this one respect, if for no other reason, the tests made at the Wisconsin University laboratories and summarized in another column are distinct contributions to our knowledge of reinforced concrete.

Methods and Cost of Constructing Six Crib Piers, Three Howe Truss Spans and One Steel Draw Span.

PART II.

THE TRUSS SPANS.

In our last issue we described the construction of the crib piers that support the four railway bridge spans now to be described.

Three Howe truss spans, each 150 ft. long, and one steel draw span, 293 ft. long were built as follows:

The Howe Truss Spans. These Howe truss bridges were erected on a pile falsework, each span having six bents of three 60-ft. piles to a bent. The outside piles of each bent were drawn in 4 ft. at the top and well braced to withstand the action of the deep swift river.

To protect the falsework against drift wood, a temporary log boom was placed on the upstream side of the bridge during erecting.

After the bridge was erected, the falsework piles were broken off at the bottom of the river.

The railway company furnished all the material for the falsework, as well as for the bridge. The contract price of $9 per lin. ft. covered the labor cost of erecting and removing the falsework, as well as framing and erecting the bridge. The cost of each of the 150-ft. Howe truss bridge spans was as follows:

88,600 ft. B. M. in bridge at $15	$1,329.00
45,600 lbs. wrt. iron at 3.5 cts.	1,576.00
38,800 lbs. cast iron at 2.5 cts.	970.00
1,080 lin. ft. piles (18) in falsework at 8 cts.	86.40
4,000 ft. B. M. in falsework at $15	60.00
Erecting 150 ft. at $9	1,350.00
Total	$5,391.40

This is equivalent to $36 per lin. ft. of bridge, exclusive of the piers and abutments, the cost of which was given in our last issue.

There was no profit to the contractor at the $9 per lin. ft. for erection, for it required 400 man-days per span. The average wages paid were $3.30 per day. Hence the labor cost $1,320 to erect the falsework and the Howe truss span. In or issues of June 26 and July 3 we have given in detail the labor cost of erecting similar bridges where the cost of erection

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was considerably less than in this instance.

The Steel Draw Span. The span was 293 ft. long, and weighed 265 tons. The steel was unloaded from cars into a material yard and conveyed on scows to the "draw protection," where it was erected by means of a traveler.

The draw protection was built in the usual manner, consisting of pile bents 10 ft. apart, three piles to the bent, each pile being 70 ft. long. A log boom was built entirely around the draw protection, the opposite sides of the boom being held together by cross logs between the 2d and 3d bents and between the 6th and 7th bents. The boom was made of sticks 60 ft. long, held together with ¾-in. chains and shackles.

The cost of the draw protection was as follows:

5,180 lin. ft. piles (74) at 8 cts...	$ 414.40
40,900 ft. B M. timber at $15....	613.50
2,800 lbs. iron at 3 cts...........	76.00
680 lin. ft. of boom sticks at 8 cts.	54.40
3,900 ft. B. M. timber wasted and in staging at $15..............	58.50
Driving 74 piles at $6.00..........	444.00
Framing and placing 40,900 ft. B: M. at $8......................	327.20
Total	$1,988.00

After the erection of the draw protection and the traveler and falsework, it required 38 days to erect the steel draw span.

In order to make sure that the panel sections of the top and bottom chords would come together before riveting, both ends of the draw bridge were jacked up after being erected and while temporarily held together with bolts. This brought all the joints of the top chord together, and, after riveting the entire top chord, the false work was knocked out, and in a suspended position the bottom chord was forced together and riveted. However, when the bridge was swung, it was found that the dead load was sufficient to cause the ends of the draw to sag to such an extent that they were 1¼ ins. below the proper level. This made it necessary to lower the pedestals on the rest piers a corresponding amount.

The cost of the draw span was as follows:

530,000 lbs. steel at 4.3 cts.......	$22,802.90
21,100 ft. B. M. ties and gd. rail $15....................	316.50
Paint	380.00
Laying timber deck 100 days at $3.30	330.00
Erecting bridge, including materials and labor on falsework (by contract)	1,750.00
Total	$25,579.40

This is equivalent to $87 per lin. ft. of bridge, not including the cost of the piers and the draw protection.

The timber deck was laid as an "extra work job" by force account, and the labor cost at least twice what it should have cost, as can be seen by reference to costs of similar work in our issues of April 17, May 8, and May 29.

The contractor received only $1,750 for erecting this 265-ton bridge, or $6.60 per ton. It actually cost him nearly $8.15 for labor alone, for it took 800 man-days at $2.70, or $2,160, to erect the traveler, the falsework and the bridge. It took 60 man-days to paint the bridge, at $3.30 per day, or $198, which is equivalent to 75 cts. per ton, making a total of $8.90 per ton for the labor of erecting and painting.

No record of the cost of the falsework for the draw span is available, but it was a comparatively small item, for no lower falsework is necessary where a draw bridge is erected on the draw protection.

For the itemized cost of erecting steel bridges, the reader is referred to our issues of April 3, 10, 17, May 8 and May 29. References have been given above to previous data on the cost of Howe truss bridges, and, in subsequent issues, further data will be given.

Cost of Riprapping Cribs with Breakwater Stone.

The following data relate to the cost of riprapping cribs with breakwater stone at Ashtabula Harbor, O. The stone was loaded from the dock into a derrick scow by the derrick, the scow was then towed an average of one-fourth mile and the stone placed, as riprap, behind new crib docks which had just been completed. The object of this crib backing was to protect the cribs from storms and also to relieve them of any lateral thrust which might cause them to move. The derrick scow used in handling the stone holds a maximum deck load of about 125 tons. The derrick boom is about 50 ft. long and all movements of the derrick are operated by steam.

The stone was placed in a mound of a triangular cross section against the cribs, the apex of this right angle triangle being at the water surface. The depth of water at the site of work averaged about 15 ft.

The stones used were irregular in shape, weighing 160 lbs. per cubic foot, the total average weight of each stone being about one ton.

The cost records below are for the months of May and June, 1907, and embraces the entire operation of riprapping the cribs, the work including: loading the stone from the dock onto the deck of the scow; towing the scow from the dock to the site of the new cribs, an average distance of about one-fourth mile; unloading the stone behind the cribs as riprap; towing the scow from the cribs back to the dock to be loaded again; lay time due to bad weather and breakdowns, interest and depreciation on value of plant and miscellaneous expense.

The scale of wages per 10-hour day was as follows:

Foreman (who was also steam engineer)	$3.00
Deck hands	2.00
Watchman	1.75

The cost of backing the cribs with breakwater stone for month of May, during which time 661 tons of stone were placed, was as follows:

	Total.	Per ton.
10 transfers by tugs at $5..	$ 50.00	$0.075
6 tons coal at $2.70.......	16.20	.024
Labor, placing stone......	47.15	.071
Lay time, due to bad weather and breakdowns	31.60	.048
Interest and depreciation on value of plant.......	90.00	.136
Miscellaneous	10.00	.015
Total	$244.95	$0.369

The cost of backing the cribs for the month of June, during which time 1,380 tons of stone were placed was as follows:

	Total.	Per ton.
24 transfers by tugs at $5..	$120.00	$0.087
17 tons coal at $2.70......	45.00	.032
Labor, placing stone......	189.15	140
Lay time, due to bad weather and breakdowns.	42.50	.030
Repairs and miscellaneous.	38.55	.043
Interest and depreciation on value of plant........	90.00	.065
Total	$545.20	$0.397

In the above tables the items "placing stone" includes the loading of stone on the scow from the dock and placing it behind the cribs. The labor cost of these two portions of the work were about equal. Interest and depreciation on plant was taken as 15 per cent per annum and was distributed over five months. The item "miscellaneous" includes wages of watchman on Sundays, and a few supplies, such as engine-oil, waste, manila lines, etc. The repairs shown in the record for June consisted of repairing the damage done to a boom being dropped by accident and breaking in two.

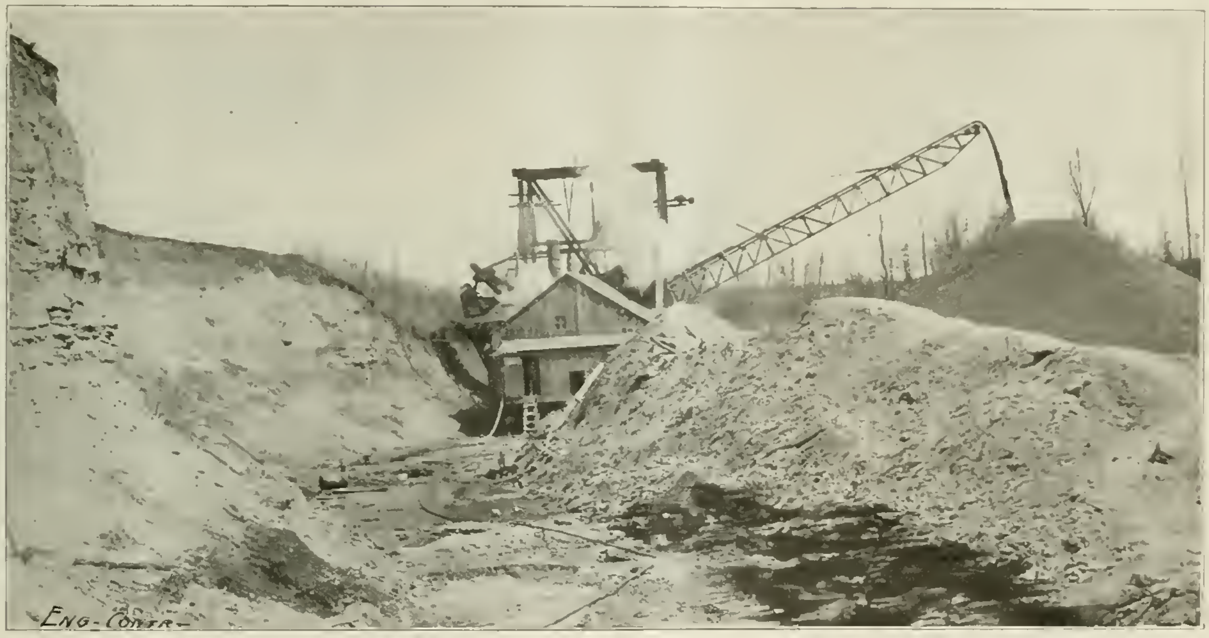
On the basis that the weight of the stone was 160 lbs. per cubic foot, the cost per cubic yard for riprapping the cribs was as follows: Month of May, 80 cts.; month of June 85 cts.

For the above information we are indebted to Mr. E. C. Bowen, Jr., Assistant Engineer, Lake Shore & Michigan Southern Ry.

According to statistics prepared by the Archive Bureau of the Prussian Railway Administration out of every 10,000 employes the relative figures of killed are as follows: In the United States, 26.1; England, 12.3; Switzerland, 8.2; Russia, 7.8; British India, 6.7; Belgium, 4.1.

A Machine for Stripping Rock and Ore Bodies.

The accompanying illustration shows a specially designed stripping excavator being used by G. W. Prutsman, of Danville, Ill., who has a contract with the Consumers' Coal Co., of Danville, to strip 35 acres of coal lands. Briefly, the proposition in hand is to remove from 38 to 40 ft. of over burden, 16 to 24 ft. being shale and the balance gravel and clay at a single cut, placing all the material to one side, leaving a bottom width of 36 ft. of clean coal ready for removal. To meet these requirements and to remove so great a depth, and material of such a nature, economically, the largest shovels with engines and cars could not keep the cost down to the limitations imposed, and a long boom machine sometimes used in similar but more shallow work with varying and uncertain results and at best slow in action was not to be considered at all. The design of a special machine for this purpose was, therefore, turned over to the engineers of the Bellefontaine Foundry & Machine Co., of Bellefontaine, O., who worked out the device illustrated.



Excavator for Stripping Rock or Ore Bodies.

The following three points were considered by the designer as essential to be met: (1) The strictly excavator portion of the machine should have a speed of operation equal to the largest steam shovel with ample power. (2) To obtain the great disposition of the material, required a second handling of about 80 per cent of all the material and this delivery must be continuous and practically automatic and require no labor in addition to that required about an ordinary steam shovel. (3) The reach or radius of action on the excavator proper should be sufficient, without sacrificing speed, to enable the operator to cast all large boulders, stones, logs, trees, etc., directly into the pit when the coal had been removed.

The following description of the general construction and operation of the machine will be of interest to those who have large earth handling propositions confronting them:

The car deck or platform proper is 30 ft. wide by 56 ft. long, mounted on four special trucks moving on two tracks, the tracks being composed of the usual short heavy sections of rails laid loose on the ties and tramed with bridle bars. The forward trucks are at the immediate front end, while the rear ones are set under some eight feet from the rear. To allow for inequality of the coal surface on which the tracks are laid, the trucks have each, one swivel axle so that the load while equal on each wheel is carried on three points. The truck bodies proper are built solid of heavy beams, and the wheels are 30 ins. in diameter and weigh 900 lbs. each, having double flanges 2¼ ins. thick and are amply strong to crowd the rails of the two tracks into proper relation to each other. When making short curves one or two of the rails are laid directly on the ties and the other on steel plates on the ties. Unusually large bolster plates bear into bolster plate sockets in the trucks, there being no attachments of any kind otherwise, so that the trucks can be swiveled short enough to turn the entire machine at right angles in less than twice its length if desired. To give the entire car body a three-point suspension on the four trucks the rear portion of the car is carried on a 5-in. swivel pin in the center of a large bolster, which in turn rests on the two rear trucks.

The company's standard design of double engines mounted in a single bed are used on all the movements of the excavator. The hoist engines are 10 x 12 ins., driving the drums through heavy steel gears with a ratio of 5.75 to 1. The drum commonly termed the backing drum is retained in this machine, but is used for hoisting or changing the elevation or angle of the elevating conveyor and not in any way in connection with the handling of the bucket. The drums are of three-part construction so that the barrels can be readily changed if desired. The usual steam clutches with outside bands wood lined, are used. The swinging rig is an 8 x 8-in. throttle reversing engine, while an engine of the same size and style built in a cast steel bed is used on the boom as a thrusting engine.

The conveyor feeder and conveyor proper are driven by an 8x10-in. single cylinder engine. Steam at 125 lbs. pressure is provided for all the engines from an open bottom locomotive type boiler 60 ins. in diameter by 21 ft. long, containing 88 3-in. tubes and rated at 100 HP. All the above mentioned machinery is enclosed within a cab the full size of the deck or car body.

The boom is 35 ft. from center to center, solid steel beams and wood combination. The dipper handle is of the same style of construction 24 ft. long and is fitted with unusually heavy steel racking. The dipper is built entirely of wrought and forged material extra heavy or rock type and has no cast steel or other cast metal of any kind in its construction. It is fitted with four heavy teeth and attached to the handle with the solid rigid socket type of connection, which is preferable to the usual pin and bar connection. An ample and fixed amount of rake is provided in the socket construction proper.

The dipper is of 2 cu. yds. capacity and is handled by 1¼-in. extra quality hand made chain.

The swinging circle is 12 ft. in diameter, made of solid plate and beam construction and is handled by double 1-in. cables to the swinging rig. The "A" frame head and shoes as well as many other parts of this machine are constructed entirely of structural shapes, plates or forged material no cast steel or other cast metal being used.

After excavating the material with the machine as above described, it is cast in a large steel hopper at one side and near the front end of the machine. From the bottom of this hopper it is carried in a uniform rate and depth by an all steel cross feeder about 12 ft. center to center to a small hopper at the lower end of the elevating belt proper. This is a 40-in. belt running on a steel arm 105 ft. center to center, which is supported on a tower 48 ft. high above the deck. This tower is located crosswise of car body and just back of the "A" frame. The dumping clearance at outer end of conveyor is nearly 60 ft. above the track. In the ordinary operation of the machine with the 24-ft. handle, all very large or heavy pieces, stumps and logs are easily cast into the space, from which the coal has been removed, direct from the hopper. Two jacks, one on either side directly under the elevator tower and directly attached to car body proper without an overhanging arm and resting on the track just back of the front trucks, prevent oscillation of the elevator or car when the machine is in operation. The usual propelling mechanism is discarded and this machine is easily moved in either direction by steel rope tackles hooked directly into the back of the dipper. Special forged track grabs which seize the rails just back of the forward trucks serve as proper hitches or anchors. Changing the forward and rear blocks from truck to track or vice versa reverses the direction of the car when pulling at the dipper. This is an extremely powerful mode of moving the car and at the same time leaves the trucks free to swivel any amount desired and eliminates chain and sprockets, clutches, etc.

The Mexican Government is said to have decided to build the Durango-Mazatlan R. R. A satisfactory route across the Sierre Madre was definitely located sometime ago. This route is 385 kilometers long, and it is said that the construction of the roadbed, exclusive of track and bridges, will cost $25,500,000, Mexican currency.

The following are some instances of the approximate average wages paid per shift to miners and artisans in the gold mines of the Transvaal, South Africa, during 1906: Timbermen, $5; miners, from $5 to $8; engine drivers, $4.75 to $5; amalgamators, $4.50; cyaniders, $3.75; fitters, riggers, boilersmiths, masons and carpenters, $5; drill sharpeners, $5.50.

The Dams of the Ashokan Reservoir of the Additional Water Supply System of New York City.

In our issue of Dec. 19, 1906, we illustrated and described in a general way the main structural features of that section of the 50-mile aqueduct then ready to be constructed for the additional water supply for the city of New York. This aqueduct begins at what will be known as the Ashokan Reservoir formed by damming the valley of Esopus Creek and extends to what will be known as Hill View Reservoir in Yonkers, just north of the New York city limits. Bids are now asked for the construction of the main dams of the Ashokan Reservoir. This chain of masonry and earth dams will aggregate in length nearly three miles, and will cost between $10,000,000 and $12,000,000.

The Ashokan reservoir, which will be the principal impounding basin in the Catskill mountains, is in the drainage area of the Esopus Creek, northwest of Kingston. This reservoir will be about twelve miles long, with a maximum width of two miles, and will be divided into two nearly equal basins, one in the valley of the Esopus Creek, and the other in the valley of the Beaverkill, a tributary of the Esopus. The waters will be impounded by a large masonry and earth dam across the gorge of the Esopus, a series of earth dikes closing the valley of the Beaverkill and adjacent depressions in the rim of the reservoir, a dividing weir between the two basins, and an overflow weir from the eastern basin. Accompanying halftone, Fig. 1, shows the gorge of the Esopus at the Olive Bridge dam site.

The principal dam, that across the Esopus, will be known as the Olive Bridge Dam, and the chain of dikes to the east have been collectively designated as the Beaverkill Dikes, and distinguished individually as the West Dike, Middle Dike and East Dike. Olive Bridge Dam will have a length of about 5,000 ft. on top, and a maximum height in the river gorge of, approximately, 220 ft. The central part will be of masonry, with a cross section, Fig. 2, substantially the same as that of the Wachusett dam, for the Boston Metropolitan Water Works, at Clinton, Mass. The earth dams will have very liberal sections, and will, besides, have substantial masonry core walls.

Abundance of good bluestone is available for the masonry, which will be of cyclopean rubble and concrete, and excellent earthy materials are available for building tight embankments. Sand, also, is found not far from the Olive Bridge Dam site. The Ulster & Delaware R. R. crosses the line of the dams, and Brown's Station is near the center of the length of the chain of dams. Olive Bridge dam site is about 1½ miles, by road, from this railroad station.

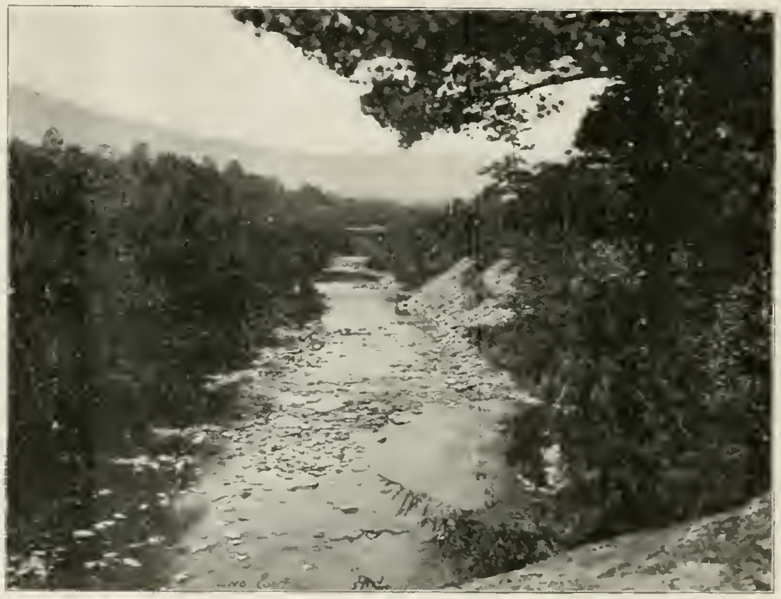


Fig. 1—Valley of Esopus Creek at Site of Olive Bridge Dam.

Esopus Creek has a drainage area of 259 square miles above Olive Bridge dam site. The dry weather flow of the stream is often but little in excess of 100 cu. ft. per second, a common range for such periods being from 100 to 300 cu. ft. per second. The creek, however, rises rapidly with heavy rainfalls and floods of 2,000 to 6,000 cu. ft. per second occur several times during the year. The brief records available show several floods as great as 12,000 to 15,000 cu. ft. per second, and the maximum of which there is any tradition is estimated to have reached about 38,000 ft. per second. At the dam site, the stream flows in a rock gorge about 40 ft. deep and 200 ft. wide. The watershed of the Beaverkill is but 17 square miles. Hence, the quantity of water to be handled in this stream, during construction, is relatively small.

Water will be drawn from both basins through a central gatehouse located at the junction of the dividing weir with the West Dike. This gatehouse will have a capacity for handling water at the rate of 1,200,000,000 gallons daily, so as to provide for a possible second aqueduct in the future, as well as supplying the aqueduct now under construction. To lead the water to this gatehouse so as to draw the two basins of the reservoir to low levels, two large channels will be required; one in each basin, excavated partly in rock, with a maximum depth of about 40 ft. A reinforced concrete arched bridge will cross the reservoir on the dividing weir, and there will be public highways on the tops of the dams. The magnitude of the proposed dam challenges attention. Approximately 1,000,000 cu. yds. of masonry of all kinds will be required, and there will be nearly 6,000,000 cu. yds. of embankments.

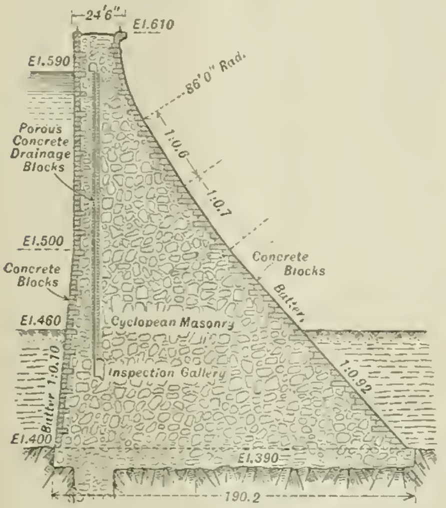


Fig. 2.—Section of Olive Bridge Dam.

A Brief History of the First City Benches of Chicago, Together with a Description of the Standard Bench Monuments Now Being Installed.

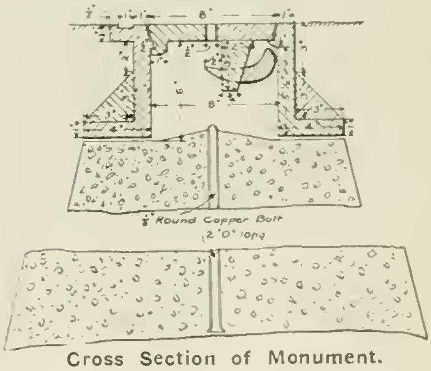
In 1855 the plane dating from the "Low Water of 1847" was adopted by the Chicago City Council as "Chicago City Datum." This plane was first taken as a base for levels in 1847 by the Trustees of the Illinois and Michigan Canal in the prosecution of that work. The first known bench mark therefrom was a point on a building at the S. W. corner of Clark and South Water Sts., known as "Loomis Store." The mitre sill of the canal lock at Bridgeport was also set by the engineers of the canal from this plane. When the canal lock was completed, a bench mark from the mitre sill was made on the top of the stone wall of the lock, where it remained until 1882, when the old canal lock bench was destroyed. Before this was done, however, Mr. Francis Murphy, then Assistant Engineer, Board of Public Works, very carefully established from it, a new bench close by, on the stone step or door-sill of the Canal Collector's office, Bridgeport. This bench was adopted by the Sanitary District Precise Levels in 1890-91, as P. B. M. No. 1, and from it all their bench levels were run.

In 1855 the bench on "Loomis Store" was still the only well known and acknowledged bench mark and in that year the "Low Water of 1847," as established by the Canal Trustees, was adopted by the City Council as "Chicago City Datum." Soon after that two other benches were established from the "Loomis' Bench Mark," one on the water table at the S. W. corner of the then Court House, and one on the water table at the S. E. corner of the "Lind Block," located at the N. W. corner of Randolph and Market Sts. These two benches were made, it is thought, by Mr. W. H. Clarke, for many years Chief of the Sewer Department. The "Loomis' Bench Mark" was destroyed some time after, and the "Court House Bench," and the "Lind Block Bench," were the points from which all benches were afterward made. The "Court House Bench," as the most convenient, was the one from which the North Side benches were run, while the West Side benches for the same reason were run from the "Lind Block Bench," both being considered the standard points. Of these two benches, that on the Lind Block was the only one remaining in 1895. So much for the first city benches. For some time previous to 1888, surveyors and civil engineers had found that the bench marks they were using were somewhat unreliable and inaccurate, and accordingly in 1888 an effort was made to re-establish a correct and uniform connection with the established "City Datum." Levels were run and the new benches were legalized by the City Council and named "Standard Benches." In 1888 the mistake was made of again establishing the new standard bench elevations, mostly on heavy buildings and on the base of towers; and it was not long before the insecurity of using such points in Chicago began to be manifest, in the disagreement of the new standards with one another, caused by the settlement of the buildings.

In 1894-95 Mr. W. H. Hedges, then Assistant Engineer in the Bureau of Sewers, ran a careful test system of exact levels, demonstrating the inaccuracy of the existing system of city bench marks. In 1895 the results of these levels were embodied in a report and the adoption of the present bench system was suggested. The report was accepted by the Department of Public Works and ordered printed; but it was not until the fall of 1897 that the Division of Standard Bench Monuments and Street Grades was established in the Bureau of Sewers, and placed in charge of Mr. Hedges. In the fall of 1897 then the construction of standard bench monuments and the running of exact levels were begun. The work was continued until the end of 1901, when there were 82 standard bench monuments. For the next three years no appropriation was available, but in 1905 funds were secured for building additional monuments and 22 new ones were constructed. No exact bench levels, however, were run in this year. In 1906 further appropriations were made and the running of exact bench levels was resumed, and in addition 19 new monuments were built, making a total of 125 since the commencement of the work. In addition 1,075 exact level bench marks have been established between the standard bench monuments along the lines of the exact levels.

The standard bench monuments to which reference has been made in this article are generally about one mile apart, north and south and east and west, and are mostly placed in the grass plat between the curb and the lot line and so planned that the top of the iron cover comes just level with the street grade or flush with the surface of the cement walk. The monuments consist of a concrete base pyramidal in form 6 ft. high and having a bottom dimention of 42 in. This base is set in the ground and on top of it is placed the iron framework and cover as shown in the accompanying cut. A ¼-in. copper rod 2 ft. long is imbedded in the concrete. The cover is lifted by a removable key which is inserted through a slot.

The materials required for each monument includes: Crushed stone, 1⅜ cu. yds.; torpedo sand, 3-5 cu. yd.; cement, 1½ bbls.; lumber for forms, 60 ft. B. M.; iron cover; ¼-in. copper rods, 2 ft. long.



Cross Section of Monument.

The lumber used in the forms is of the cheapest common lumber, cut to fit the pyramidal outline of the monument, and it is left in the ground on the completion of the work.

The monuments were placed by one of the repair gangs of the Bureau of Sewers, the gang consisting of one foreman and four laborers; two teams were also used. In 1906 the average cost of each monument was $24.12. From one to three monuments were constructed each day, the average number being two per day.

We are indebted to Mr W. H. Hedges, Bench and Street Grade Engineer, Department of Public Works, Chicago, for the information from which this article was prepared.

Methods and Costs; Some Old, Some New.

Dredging Out Rubble.—A 400-ton hopper bucket dredger was used in excavating the base of the harbor arm at Madras Harbor, India. About 75 per cent of the material removed was rubble of all sizes up to half a ton, the remainder being sand and mud. As the rubble was closely packed in mud and would not drop out of the buckets freely, it was found necessary to drill a couple of 1-in. holes in each bucket. This was quite effective.

Steel Stack Extension.—Owing to the erection of an adjoining high building it became necessary to extend the smoke stack of a neighboring building. The stack was of the steel plate type, 6 ft. in diameter, and it was decided to add 60 ft. to its height. It was necessary to do the work while the chimney was in service, and accordingly holes for the discharge of the smoke during the extension were made in the top course of the stack. The regular discharge top was closed and a working platform hung a few feet below the openings, and the sheets riveted successively in place, the platform being used as the lower stage of scaffolding to which the plates were hoisted from the roof and from which they were hoisted into position. The sheets were 3/16 in. thick.

Gavity Elevator.—The elevator described below was used by a building wrecker in tearing down an old building, as a means of carrying bricks and other material to the ground floor without damaging them. The elevator consisted of two platforms, each capable of holding one wheelbarrow, suspended by a 1½ in. rope from a 4 ft. grooved iron wheel having a 1½ in. face. The guides consisted of three pieces of 2x10 in. timber braced to the joists at each floor, the middle guide being somewhat longer than the two outer guides and supporting the grooved iron wheel. When a barrow was filled with bricks it was wheeled directly onto the platform, which is adjusted to the level of the lightest floor when the other platform just reaches the ground floor. The weight of the loaded platform causes it to descend, at the same time raising the other platform with the empty barrow to the top floor for reloading. The descent of the loaded barrow is controlled by a lever and wire rope attached to a single friction brake.

Bailing Out a Mine Shaft.—The workings of a coal mine having a vertical shaft 11 ft. square and 610 ft. deep became filled with water, and as boilers, an air compressor and a 14x24-in. hoisting engine had already been installed it was decided to unwater the shaft by means of buckets, and to install pumps at the lower levels for drawing the tunnels and drifts. The 11 ft. shaft had a plank diaphragm through the center, and one side of it had been divided into two compartments with guides for the cages. Steel buckets, 3½x3½x6 ft. deep were built to run in these guides. The buckets were duplicates and were built to counterbalance each other. They were suspended from their bails by a steel rope from the winding drum, which was geared to the engine so as to make one revolution to six of the latter. At the bottom of each bucket was a hole which was closed by a flap valve. A tripper arrangement opened this valve when the bucket rose above the top of the shaft, causing the water to be discharged. The two buckets averaged a trip every three minutes, raising water at the rate of about 20,000 gallons an hour.

Grouting Gravel for Foundation Work.

The river bottom at the site selected for the erection of a bridge consisted of gravel with pockets and layers of very compact sand extending to a depth of 10 to 14 ft. below low water and underlaid directly by bed rock. The mean depth of the river at low water was about 8 ft. The abutments and piers of the bridge were founded on a mass of concrete formed in place by injecting a thin cement grout into the water bearing gravel. Twelve-foot lengths of 1½ in. pipe with an iron driving point attached loosely to the lower end were driven down to rock. The pipe was then raised a few inches, lifting it clear from the driving point and cement grout pumped in until the rise in pressure indicated saturation. The pipe was then drawn up a few inches and grout again pumped in to saturation, and the operation continued. The pipes were driven down at intervals of about 20 ins., and subsequent excavation showed that the distance to which the cement had flowed varied greatly with the amount of sand contained in the gravel. In compact sand layers cement had practically failed to penerate; but where the gravel held but little sand the cement was found in some cases at a distance of several yards from the pipe. It was found the cement had set in a satisfactory manner. This method was used in founding one of the abutments. In founding the two river piers, sheet pile cofferdams were driven to rock and made watertight by injecting cement grout through pipes driven around them. At one of the piers the grouting was carried out only outside of the cofferdam to make it water tight, so that the interior could be excavated directly to bed rock. At the other pier, however, grouting was carried on through pipes driven outside and inside of the cofferdam, and as a result nearly the whole mass of the interior of the cofferdam was converted into a block of concrete.

Cost of Producing Electric Power.—The following figures are given of the cost of producing electric power at the station of the Cincinnati, Milford & Loveland Traction Co., operating 36 miles of interurban electric railway. The plant is briefly described as follows: The boilers are four 400-H.P. Sterling, operating under natural draft furnished by two 54-in. x 100 ft. steel stacks. Four 6x4x6 in. Dean pumps in duplicate handle the feed water, one pump running water to an 800-H.P. Cochrane open type heater where the temperature is raised to 210° F. and the other pump running the water from the heater to the boilers. Condensing water is supplied to a 750-H.P. Tomlinson condenser by two single stage centrifugal pumps direct operated by 7x7-in. marine engines. These pumps operate at 300 r. p. m. and deliver 1,200 gallons per minute. The circulating pumps set in a 12-ft. pit in the boiler room and have a minimum lift of 54 ft. The engines are 16x34x42-in. Allis-Chalmers cross-compound condensing. In order to give a high output for their size the engines are operated at 125 r. p. m. The generators are 500-k.w. Bullock revolving field machines. They generate 3 phase 25 cycle current at 400 volts pressure and have an output of 721 amperes. Current for distribution of fields and for station lighting is furnished by 22½-k.w. 125 volt generators belted to an extra wheel belted to the spokes of the flywheel. The following is the statement of the output and operating cost of this station for one month:

Labor:	
2 engineers	$150
2 oilers	100
2 firemen	100
1 general help	45
Total	$395
Fuel and Supplies:	
342 tons coal at $2.10	$718.20
Oil and waste	37.10
General supplies	33.25
Total	$788.55

The output in k. w. h. was 168.000, so that the cost per k. w. h. at the switchboard was as follows:

Item.	Total.	Per k.w.h.
Labor	$395.00	$0.00235
Fuel and supplies	788.55	0.0047
Total	$1.183.50	$0.00705

The total amount of coal burned during the month was 684,000 lbs., or 4.07 lbs. per k.w.h.

During 1906 the total number of gallons of water pumped in the city of Chicago was 159,488,382,740, an increase over 1905 of 9,528,092,958 gallons. Based upon a population of 2,140,000, this means that 204 gallons of water per capita were pumped every day of the year.

Contractors Plant and Construction Methods; Jones & Laughlin's Steel Plant, Aliquippa Park, Pa.

The new steel works for Jones & Laughlin now being constructed at Aliquippa Park, Pa., near Pittsburg, will comprise ten hearth furnaces. The foundations and collateral works for these blast furnaces necessitated the excavation of some 165,000 cu. yds. of earth and the mixing and placing of some 215,000 cu. yds. of concrete. Because of the large amounts of material to be handled and particularly because of the wide distribution of the concrete work, the contractor's plant and construction methods are of considerable interest and we give some space to a description of them from information and sketches furnished by Mr. Charles M. Ripley and approved by the engineers in Chicago.

Excavation.—The amount of excavation required for each blast furnace foundation was approximately 15,000 cu. yds., making for the ten furnaces 150,000 cu. yds. As shown by the general plan of the contractor's plant, Fig. 1, the ten furnaces are arranged in a single row. Each furnace foundation was approximately 300x75 ft., and had to be excavated 18 ft. deep. Steam shovels were used for excavation. Fig. 2 shows roughly the layout of the excavation for two furnaces. Two shovels were used, one a Marion with a 2½-cu. yd. dipper and the other a Thew with a 1-cu. yd. dipper. These shovels traveled on the center track, digging in front and on each side. They loaded the material onto ordinary flat cars holding about 16 cu. yds. each, which were hauled by locomotives about 1,000 ft. to a fill. Three locomotives were used for hauling and placing the cars.

The Marion shovel was handled by three men at $4 each per day; in addition there were four trackmen at $1.50 each per day. The Thew shovel required two men at $4 per day and four trackmen at $1.50 per day each. Fifteen cars were used for hauling the excavated material, each provided with a shovel gang of eight men.

The first two furnace excavations were accomplished in six weeks or at the rate of about 5,000 cu. yds. per week. No water was encountered so that pumping and sheet piling were unnecessary. No foundation piles had to be driven.

Mixing Concrete.—In arranging the mixing plant advantage was taken of a 40-ft. sidehill to reduce hoisting expenses. Figure 1 indicates the arrangement of the mixing plant in plan and Fig. 3 shows a diagram side elevation. The trestle work was made of 12x12-in. timbers and is approximately 40 ft. in height. As indicated in Fig 1 three tracks occupy the topmost platform. Under each track is a material bin; one on each side for gravel and a middle bin for sand. The middle bin is divided by a partition into two compartments. These bins discharge into two measuring hoppers, one gravel bin and one compartment of the sand bin into one hopper and the other gravel bin and other compartment of the sand bin into the second hopper. Two cement chutes from the top platform provide for the delivery of the cement to the mixers, either directly from cars or from the cement storage house. The mixing is done in two Smith No. 5 mixers, one under each measuring hopper, and these mixers discharge by chutes into buckets on flat cars. Briefly stated, the concrete materials are brought directly from the siding in carload lots to the top platform and thence are handled entirely by gravity to the cars delivering the mixed concrete to the work.

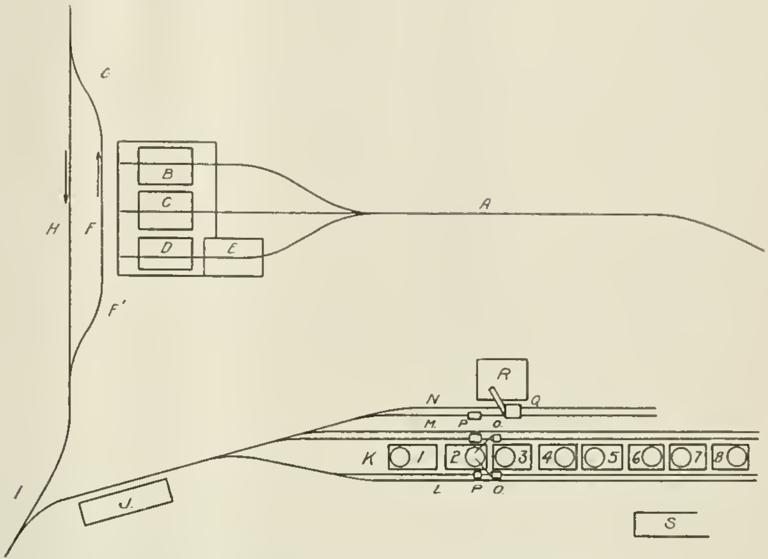


Fig. 1.—Lay-out Plans of Construction Plant.

A, spur to main line of P. & L. E. R. R.; B, gravel bin; C, sand bin; D, gravel bin; E, cement house; F, down grade track where buckets on cars are filled with concrete; G, switch to which these cars discharge by gravity; H, point at which these cars stop waiting for locomotive; I, Y, allowing locomotive always to be between mixing plant and job; J, store house; K, row of ten blast furnaces; L, double track to the west of blast furnace; M, double track to the east of blast furnace; N, double track to the west of the blower house foundations; O, two special stiff leg derricks with 60 ft. booms; P, P P P cars containing Excelsior Buckets, waiting to be lifted and dumped; Q, locomotive crane used for depositing concrete within narrow radius; R, blower house foundations; S, brick yard; F′, point on down grade at which locomotives drop cars with empty buckets.

The gang operating the mixing plant consists of one foreman and engineer at $3 per day; 1 fireman at $2 per day and 15 laborers at $1.50 per day. With this gang the two mixers turn out approximately 400 cu. yds. of 1-3-5 concrete per day. An output of 800 cu. yds. in 24 hours is not an unusual record.

(Taking these figures as correct we may figure the labor cost from the raw materials in cars on the platform to mixed concrete in cars on the delivery track as follows, assuming 400 cu. yds. output per shift.

1 foreman and engineer at $3	$ 3.00
1 fireman at $2	2.00
15 laborers at $1.50	22.50
Total labor	$27.50

$27.50 ÷ 400 = 6.875 cts. per cu. yd.

Working three eight-hour shifts in 24 hours the labor cost would be: ($27.50 × 3) ÷ 800 = 10.4 cts. per cu. yd.—Editor.)

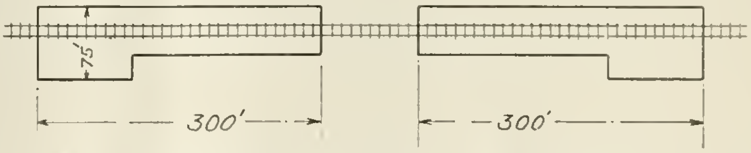


Fig. 2.—Sketch Plan Showing Two Foundations With Steam Shovel Tracks.

Transporting and Handling Concrete.—The mixed concrete in buckets on flat cars is transported to the site by means of the track system shown by Fig. 1, where the buckets are handled to the work by means of special traveling derricks. Both the track system and the special derricks exhibit points of interest.

Referring to Fig. 1, the arrows indicate the direction of down grade on the several tracks. Trains of two flat cars are used, each one carrying five Excelsior bottom dump buckets made by the G. L. Stuebner Iron Works, Long Island City, New York. Coming from the work the train is taken by locomotive to the point F′, where it is cut loose and proceeds to the mixer by gravity. After the buckets are loaded the train proceeds to B, where the grade is reversed and an automatic switch allows it to drop back to point F′, where it is again taken up by the locomotive. It will be noted that by means of the Y the locomotive keeps always between the train and the work; one locomotive, therefore, handles all trains.

At the work the buckets are lifted from the cars, one at a time by derricks, swung to position and dumped by one man. The derrick used for handling the buckets is shown in detail by Fig. 4, and Fig. 5 is a

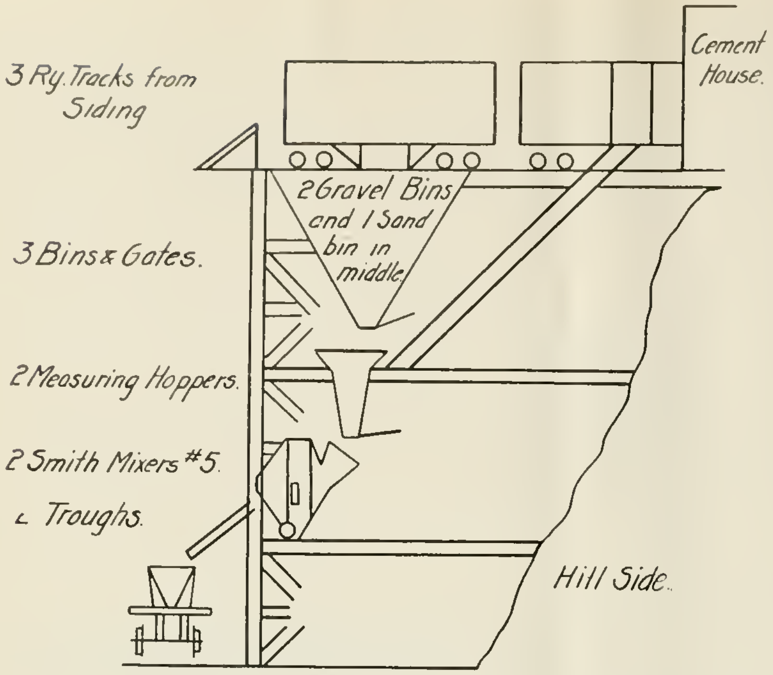


Fig. 3.—Diagram Side Elevation of Concrete Mixing Plant.

view of the machine in operation. Two derricks of this construction are used, both built by the Carlin Machinery & Supply Co., Allegheny, Pa.

Owing to the limited space, the gage of these derrick cars was made 10½ ft. and the complete equipment 36 ft. long. The A-frame or front support for the derrick mast is, however, 28 ft. wide with screws for supporting it from the ground after the car is moved to position.

A novel and substantial method of securing the top of mast sufficiently ahead or in front of the A-frame, is shown in the drawing so that the 60-ft. boom of the derrick will travel through an arc of about 190°. The machinery is designed for operating a 1-cu. yd. Hayward clam shell bucket, using an 8½x10-in. Lambert special hoisting engine with three friction drums and special boom swinging attachment wherein two small drums were used, permitting all lines to clear each other freely by the original method of placing the sheaves at the bottom of the mast.

The derrick base proper is made in three parts: Base plate having large surface for securing to timbers; the derrick base proper, which forms a seat for mast, and the removable knee or boom seat. This base has ample clearance for three ropes, its bearings being 11 ins. in diameter. The knee can be readily replaced without materially disturbing other parts of machine.

The improved mast top in addition to forming a support for the gudgeon pin which is in front of the mast, allowing the mast timber proper to be perfectly vertical so that it can readily be plumbed and the top and bottom bearings put in perfect alignment, also cares for three sheaves for properly lacing the boom raising rope. The sheave pin in addition to its bearing in the casting is further supported by heavy steel stirrups passing through the top of the mast with washer plates on the back. The turntable or bull wheel in this case consisted of a simple angle iron rim filled in with wood braces.

The long boom is partially supported by the boom bail secured by the end of the boom line which has two supporting sheaves built into it for carrying the hoisting and closing lines. A simple and novel set of irons is made for the boom top lift, consisting of a long steel plate covering the two sides of the boom and passing around the end with a built-up double block for lacing the ropes. The arrangement is so designed as to give ample support for all pins, and to permit of all sheaves, which are mortised in center of boom side by side, being rapidly renewed. A simple counter weight is furnished for preventing the bucket from turning and

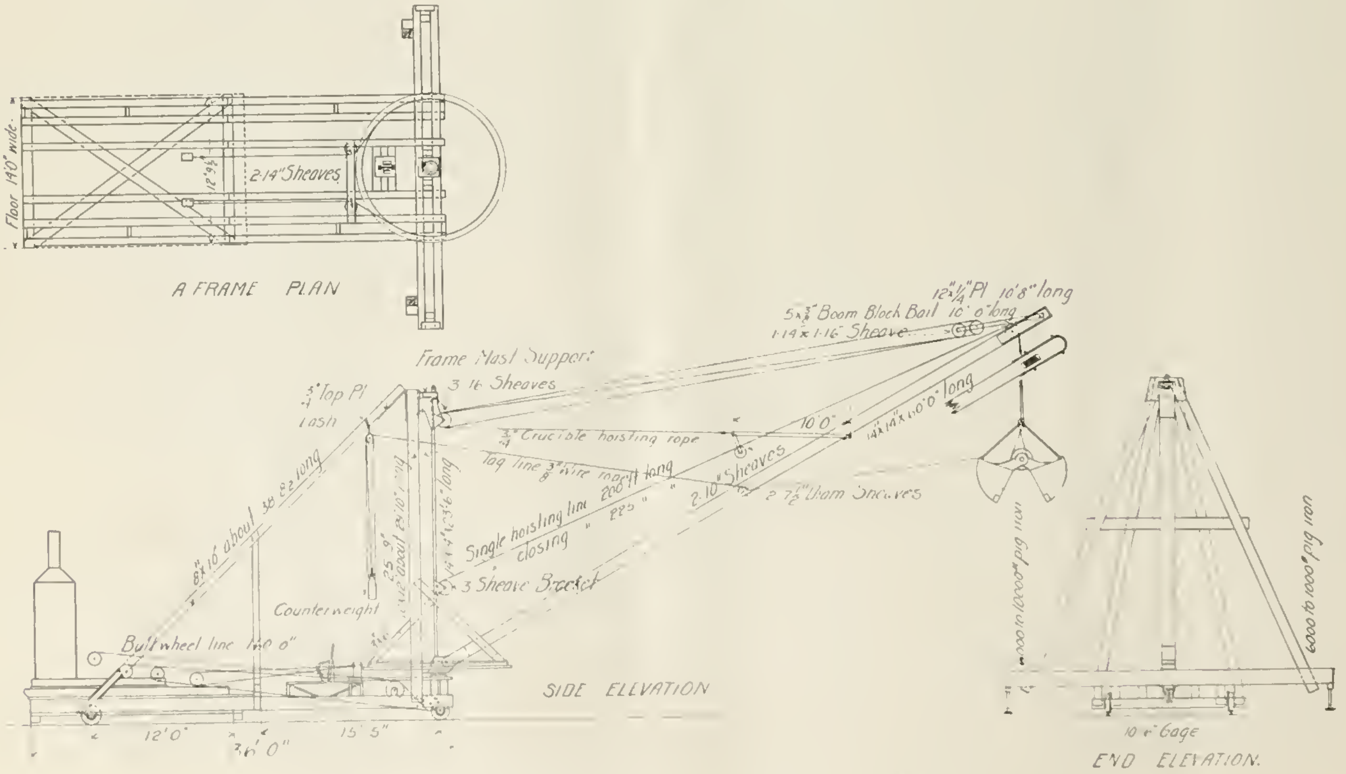


Fig. 4.—Details of Special Derrick for Handling Concrete Buckets.

twisting the bucket lines. As stated above the main use of these derricks at the present time is in depositing 800 cu. yds. of concrete every 24 hours, working night and day. This concrete is dumped direct inside of the circular brick exterior walls of the blast furnace foundation.

In addition to these two special derricks a Bay City locomotive crane was used for handling buckets.

The plant as described was put in by Jones & Laughlin, who are doing the foundation work themselves. The blast furnaces will be built by the Riter-Conley Mfg. Co., of Pittsburg, Pa.

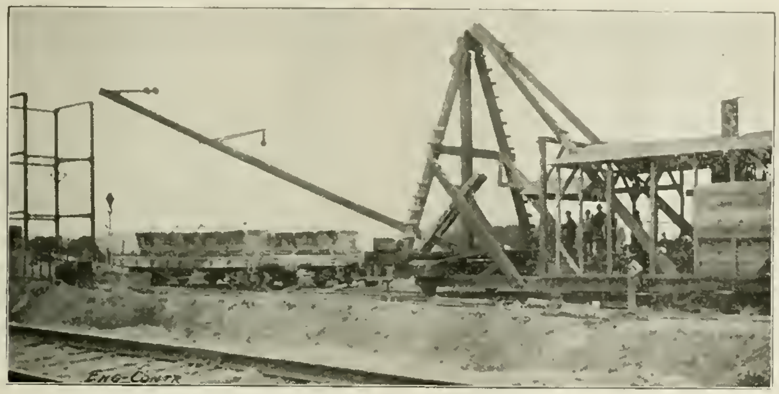


Fig. 5.—View of Special Derrick Handling Concrete Buckets.

The Minister of Public Works of France has recently caused to be signed a decree ordering the employment of respiratory apparatus in the mines of that country. Every mine employing 100 men underground at the same time must be provided with portable respiratory apparatus, ready for immediate use and capable of allowing a miner to remain at least one hour in an irrespirable atmosphere. The number of these apparatus must be not less than two for each pit, placed in charge of an engineer or inspector familiar with their working, and provided with ten picked men, who will be trained in the use of these apparatus and sent to the seat of danger immediately whenever the necessity arises.

The South Manchurian Ry. Co. intends, it is said, to expend about $50,000,000, as follows: For broadening the gage for the whole length of the railway, $10,000,000; for improving the harbor of Dalny, $2,500,000; for double tracking the railway from Dalny to Sojatung (the first station south of Mukden), $4,800,000; for capitalizing the Fushin and Yantai coal mines, $2,000,000; for buying land and erecting godowns, $4,000,000; for capitalizing the marine transportation service, $5,000,000; for improving the railway between Antung and Mukden, $11,000,000; and for a reserve fund, $5,700,000.

Summary of Tests on Reinforced Concrete Beams at the University of Wisconsin Laboratories.

Among the laboratory investigations of concrete and reinforced concrete which have been carried out in this country those conducted at the University of Wisconsin occupy a prominent position. The investigations on reinforced concrete beams were begun at these laboratories in 1903 and have continued for about three years. Reports on these tests have been made at various times, but they have recently been collected and summarized in a Bulletin issued by the University and prepared by Mr. E. A. Moritz, Instructor in Mathematics. While this summary is too long, with its large amount of tabular matter, to be given in full some account of the important facts brought out by the tests is desirable and we give in the following pages the main facts in condensed form.

In addition to the general observations on the action of reinforced concrete beams under stress separate discussion is given to such particular phases of the subject as: (1) The early appearance of minute cracks on the tension side of the beams; (2) Position of the neutral axis; (3) Efficiency of different methods of reinforcing in preventing inclined tension failures; (4) Tests on sixteen 8x11-in x 13-ft. beams.

It would take too much space and would be of little value to enumerate the details of the tests of component materials, kinds of molds, manner of mixing concrete, etc. A few general statements regarding these various elements will be sufficient.

Both mortar and concrete beams were made. The usual consistency of the mixture was such as might be termed medium. It was such that when turned over with a shovel or lightly patted, water would flush to the surface. Of the beams made in 1902-03 some were stored in water and some in air. All the beams made in 1903-04 were stored in water. Those made in 1904-05 were stored in air. All the beams were made and kept in the laboratory which usually had a temperature of about 65° F. All materials were proportioned by weight and mixed by hand. Natural pit sand, unwashed, was used, with crushed limestone less than 1 in. in diameter for the aggregate. Only the best brands of Portland cement were employed, including Alpha, Atlas and Vulcanite, while for the 8x11-in. beams the mixture furnished by the Joint Committee on Reinforced Concrete was used. The cements all tested up to the specifications of the American Society of Civil Engineers.

All the beam tests were made on a 100,000-lb. hydraulic, beam-testing machine. The loading points and supports were provided with rockers to allow the beam to adjust itself laterally. No rollers were placed under the supports to allow for longitudinal adjustment. Cubes were bedded in plaster of paris which was allowed to set under a 1,000-lb. load before the breaking load was applied. Attempts to determine the coefficient of elasticity of mortar and concrete resulted unsatisfactorily on account of lack of proper instruments. Consequently no results are given for these tests.

In the tests made in 1903-04 deflections were measured with a micrometer apparatus. In 1904-05 all the deflections were measured by means of a thread and a polished scale reading to 0.01-in. attached vertically at the middle of the beam. The extensometer apparatus was specially constructed for this purpose. It consists of two sets of frames clamped to the sides of the beam, one set carrying four graduated dials with pivoted pointers, while to the other set are attached posts. Very fine copper wires are fastened to these posts and led over pulleys attached to the pointers. Small weights serve to keep the wire taut. The dials are graduated to read to 0.001 in. directly and to 0.0002 in. by estimation. Deformations are read on both sides of the beam. Silk threads were used at first instead of the copper wires, but it was found that the slightest bit of moisture coming from the breath of the observer would cause the dials to move over several divisions. The thin copper wires were found to be entirely reliable.

In computing stresses in steel and concrete the centroid of compressive stresses is assumed to be two-thirds of the distance from the neutral axis to the outer fiber (except where otherwise stated), corresponding to a straight line variation of stress. The total stress on the concrete or steel is then found by dividing the bending moment by the distance from the center of the steel to this point. Dividing this total stress by the area of concrete in compression gives the average unit compressive stress, which multiplied by two gives the stress on the outer fiber.

APPEARANCE OF FIRST MINUTE CRACKS.

The appearance of the first minute cracks in reinforced concrete beams under stress has been the subject of some controversy among investigators. According to tests made by Considère in France the first cracks on the tension side of a beam do not occur until the extension is about ten times as great as concrete of the same quality, unreinforced, will stand. Considère makes use of this supposed phenomenon in his formulas by assuming that the concrete carries part of the tension up to the safe working stress of the steel.

To determine if possible the reliability of the above results, a test was made similar to Considère's. The system of loading used gave a uniform bending moment over the middle 8 ins. of the beam. Considère subjected his beams to a uniform bending moment over the entire beam. In order to note the cracks more readily, the beams were tested with the tension side up. It had been previously observed by Mr. Hartman that during the first stages of the test wet streaks occurred on the tension face of the beam, and by further observation it was noticed that these wet streaks afterward developed into cracks. This gave a convenient means of finding when the first crack occurs. These wet streaks or "water marks" as they will be called, were found to occur only in beams which have been stored in water and thus contain considerable moisture. The beams were removed from the water several hours before testing so that although when tested the surface was dry considerable free moisture was contained in the body of the beam. The probable explanation of the appearance of water marks is that, when a very minute crack occurs on the surface and gradually extends into the body of the beam, the water is brought to the surface by capillary attraction.

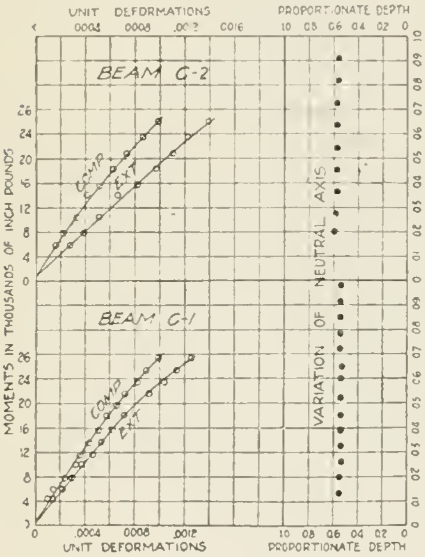


Fig. 1.

To determine the truth of the assumption that the water marks were actually minute cracks, a special test was made on a beam by Messrs. Hartman, Adams and Hahn. This beam was 3x6 ins. in section, 50 ins. long (48 ins. span), reinforced with one ½-in. Ransome twisted bar, was loaded with two concentrated loads 4 ins. on either side of the center, and was tested at the age of six months. The load was applied slowly until several water marks had developed across the face of the beam. No crack was visible to the naked eye, but with the aid of a microscope a crack about ¼ in. long could be seen at one of the marks. The load was now removed and by means of an emery saw a slice of the beam between the steel and tension face was removed. When the saw reached the first water mark the piece fell out, and as each mark was reached another piece fell out, showing that cracks existed at these points. These slabs were tested in bending and found to be perfectly solid between marks.

It is thus evident that the concrete cracks much sooner than can be detected with the eye, and having once cracked, no matter how minute the crack may be, its strength in tension is zero. In later tests these water marks were found to occur when the stress in the steel was as low as 3,000 lbs. per sq. in. Variations in this respect among the different beams may be due to the fact that some of the beams, when tested, were wetter than others, but it is to be expected that in work of this character the accidental variations will be considerable. For structural purposes the working strength of mild steel is usually taken as from 12,000 to 16,000 lbs. per sq. in.; consequently it is plain that the concrete has lost practically all its tensile resistance long before the steel is stressed up to its working load, and therefore cannot be counted on to take any part of the tension at that load.

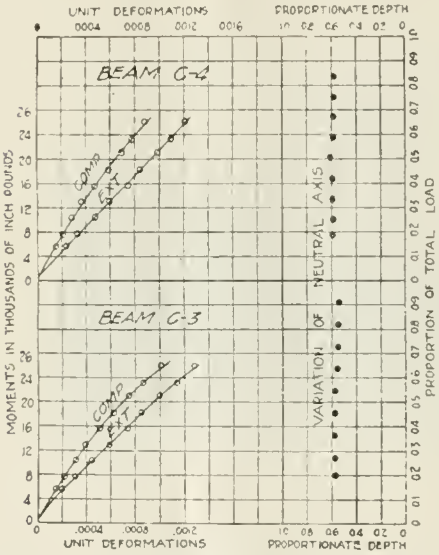


Fig. 2.

Comparative tests of reinforced and plain concrete beams showed that the first water marks appeared on the reinforced beam at about the same load at which the plain beam failed. No water marks were observed on the plain beams, as those beams failed suddenly when the ultimate tensile strength of the concrete was reached. In the reinforced beams the concrete had stretched considerably more when the first *visible crack* was observed than had the plain beam, at rupture; but it will be found that the first appearance of the water marks, which are really minute cracks, coincides closely with the point of rupture of the plain beam. The elongation of the concrete at the time when the first water mark was observed varied between 0.0001 and 0.0002-in. corresponding to an average stress in the steel of about 3,000 to 6,000 lbs. per sq. in. The appearance of the first minute cracks seems to be indicated also on the stress-strain curves; most of these curves have a sharp bend at the point corresponding closely to the beginning of these cracks, indicating a change in the law of deformation at this point.

TABLE 1.—*Moments of resistance of beams.*

No. of beam	Actual moment of resistance; inch-pounds.	Area of steel; square inches.	Calculated stress in steel; pounds per square inch.
5 and 7.......	104,000	0 389	61,000
8.............	77,000		46,000
9 and 11.....	79,000	0.350	52,000
10 and 12.....	78,000		52,000
13 and 15......	103,000	0.385	61,000
14 and 16......	104,000		61,000
21 and 23......	88,000	0.385	52,000
22 and 24......	97,000		57,000
25 and 27......	96,000	0.320	70,000
26 and 28......	95,000		70,000
29 and 31......	120,000	0.350	78,000
30 and 32......	95,000		62,000
33 and 35......	77,000	0.350	52,000
34 and 36......	74,000		50,000
37 and 39......	112,000	0 385	65,000
38 and 40......	113,000		65,000

POSITION OF THE NEUTRAL AXIS.

In connection with the position of the neutral axis the main points discussed are the position of the axis obtained from tests as ordinarily made; the position as found in beams with the rods exposed so as to be unaffected by the surrounding concrete; the movement of the axis; and a comparison of the results with theory.

Messrs. Gilman and Kahn made their tests on beams arranged in the usual way, that is, with the rods completely surrounded by concrete. Table 1 shows the moments of resistance and calculated stresses in the steel of these beams. These stresses were computed by assuming the center of gravity of compressive stresses to be five-eights of the distance from the neutral axis to the outer fiber of the beam, corresponding to a parabolic variation of compressive stress. Stresses calculated on the assumption of a straight line variation would differ from these by about 2 per cent, the straight line assumption giving the smaller values. In Table I the average for the one-month beams is given first in each group and that for the three-month beams just below.

The stresses in the steel as here calculated, which cannot be greatly in error, will be seen to be in nearly every case much higher than would be deduced from the observed elongations of the steel, using the usual modulus of elasticity. Thus in the case of beam No. 12, the elongation at rupture was 0.00115. Assuming a value of E equal to 29,000,000 the stress would be 33,000 lbs. per sq. in., whereas the calculations from actual moment give a stress of 53,000 lbs. per sq. in. This discrepancy is doubtless due partly to the initial tension which probably existed in the rods, as the beams were hardened under water. This tension, of course, would not be indicated in the extensometer readings. That there was such a large initial tension seems to be shown by later tests on beams hardened in air, in which the agreement between the two calculations was much closer. The remainder of this discrepancy, as will be shown, is probably due to the fact that the elongations as obtained above, do not represent the actual stretch of the steel at every point but merely show the average elongations; that is, the steel stretches much more, and is consequently stressed higher at the points where the concrete cracks, but these large local elongations are not shown in the extensometer readings. The reason for this is that the gripping of the concrete around the steel prevents it from stretching freely excepting at the points where the concrete cracks. Where there are no cracks, the concrete helps to carry the stress; and where there are cracks, the stress is carried entirely by the steel.

As the extensions as obtained above are only the average, the position of the neutral axis as obtained from these extensions would be only the average position, its position where cracks occur being higher than over other portions of the beam.

To study this point more fully beams were made with the steel exposed over the middle portion of the beam on which extensometer readings were taken. By this means it was hoped to obtain the actual position of the neutral axis and stretch in the steel unaffected by surrounding concrete. The first test of this kind was made on four 5x3x48-in. mortar beams containing four ¼-in. round rods and having the steel exposed over the middle 16 ins. The beams were subjected to a uniform bending moment over the portion covered by the extensometer readings. The stresses in the steel were calculated from the bending moments on the assumption of a straight line variation of stress and also from the actual extensions. The results of these calculations are given in Table II. Reference to the table will show that the agreement between the two stresses is quite close, much closer than has been found for beams with rods covered, an indication that the concrete surrounding the rods in beams as ordinarily made has a considerable influence on the strength of the steel. It thus influences the calculated position of the neutral axis, the tendency being to give a position nearer the steel than is actually the case.

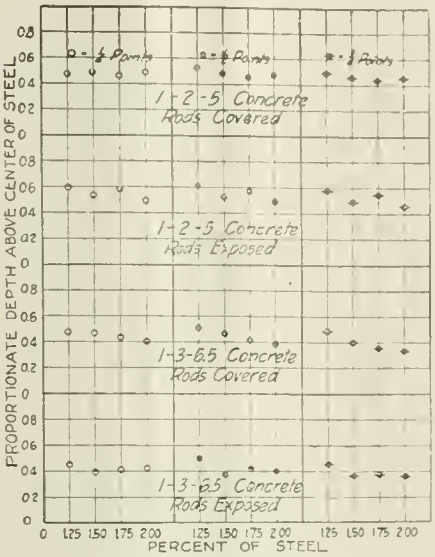


Fig. 3.

In this table it is seen that for small loads the stresses computed from extensions are smaller than those computed from moments, a condition due, no doubt, to the fact that at this stage the concrete is taking some tension, the steel being relieved by this amount. After the concrete begins to crack the steel takes more of the tension and the elongation becomes correspondingly greater. Figures 1 and 2 show the stress-strain diagrams and positions of the neutral axis for the beams given in Table II. Similar reference to the diagrams for the 8x10-in. beams, half of which had the rods exposed, will show that the neutral axis in nearly all cases is higher in the beams with the rods exposed than it is in the corresponding beams with the rods covered. The bend in the stress-strain curves, indicating the point at which the concrete cracks, occurs earlier in the exposed-rod beams; a natural result, since the concrete in the beams with rods covered was about 1½ ins. deeper and consequently offered greater resistance than in the other beams.

In nearly all the beams tested, the position of the neutral axis was found to be between the limits 0.4 and 0.6 of the depth of the beam above the center of the steel, the average being somewhat over .05. In the 8x11-in. beams of 1:3:6.5 concrete the axis is somewhat lower, varying approximately between 0.3 and 0.5 of the depth.

The position of the axis in the sixteen 8x11-in. beams is shown in Fig. 3. The effect of increasing the percentage of steel is to draw the axis downward, as would be expected from theoretical considerations. In Fig. 4 is shown the theoretical curve for the position of the neutral axis with percentages of steel up to two per cent. This curve was calculated on the assumption of a straight line variation of stress and a ratio of the coefficients of elasticity of steel and concrete equal to 15. Its equation is:

$$X = 0.15\ P + 1 - \sqrt{(0.15\ P + 1)^2 - 1}$$

where X = Proportionate distance of neutral axis above center of steel.

P = Per cent of steel.

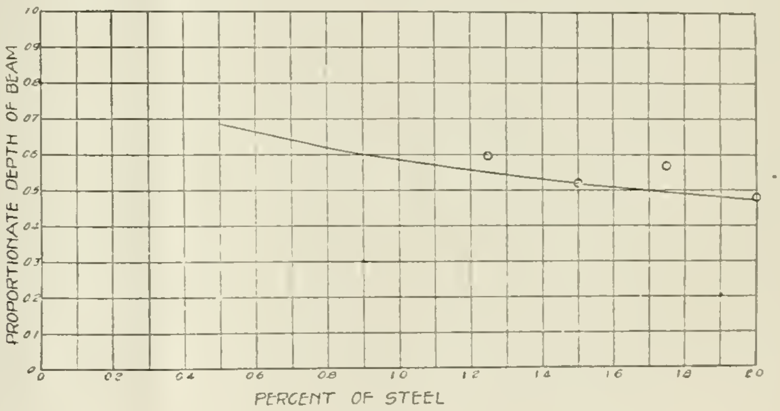


Fig. 4.

The separate points indicate the position of the axis as determined in four of the large beams with the rods exposed. They agree fairly well with the theoretical curve.

In view of the results of this investigation and the published results of other tests, it would seem more direct and quite as accurate in the case of rectangular beams, to assume the position of the neutral axis, rather than to assume the coefficient of elasticity for the concrete and then compute the position of the axis from theo-

TABLE II.—*Comparison of stresses calculated from extension and from moments.*

Load.	Beam C 2.		Beam C 3.		Beam C 4.		Beam C 1.		
	Sm.	Se.	Sm.	Se.	Sm.	Se.	Load.	Sm.	Se.
900	7,400	8,500	7,500	5,800	7,500	7,000	2,100	17,800	15,600
1,200	9,850	11,600	10,100	8,900	10,000	9,900	2,400	20,300	18,200
1,600	13,250	15,200	13,500	13,000	13,300	14,000	2,700	22,800	21,000
2,000	16,600	19,300	16,800	17,200	16,700	17,600	3,000	25,400	22,900
2,400	19,900	23,500	20,100	21,500	20,000	23,500	3,300	27,900	26,600
2,800	23,300	28,300	23,500	24,700	23,300	26,400	3,600	30,400	30,000
3,200	26,700	32,100	26,900	28,700	26,700	30,900	3,900	32,900	32,900
3,600	30,200	36,600	30,200	33,000	30,000	33,900	4,200	35,500	36,600
4,000	33,600	40,400	33,600	37,200	33,400	36,800	4,500	38,000	39,100

Sm. is the stress in the steel as computed from bending moments.
Se. is the stress in the steel as computed from measured extensions.

retical considerations. The above results indicate that an assumption of 0.55 of the depth above the steel for the position of the neutral axis would not be greatly in error in any beam in which the percentage of steel is from 1 to 1¼. This assumption makes the lever arm of internal stresses 0.85 of the depth of the beam.

The variation in the position of the neutral axis as the load is increased is not large up to about three-fourths of the maximum load, except at the very beginning of the test. Here the change is quite rapid until the point is reached where the concrete cracks, after which changes are much smaller.

(To be continued.)

BOOK REVIEWS.

A Collection of Practical Articles on Mine Timbering.

MINE TIMBERING.—By Wilbur E. Sanders, Bernard MacDonald, Norman W. Parlee and others. Hill Publishing Co., New York. Cloth 6⅛x9⅛ ins.; pp. 179; 140 illustrations; $2.

While many of the general treatises on mining contain chapters of more or less value on the important subject of timbering, there is no book which to our knowledge discusses the subject thoroughly and comprehensively. The book before us lays claim to no such completeness, but it is a far more valuable treatise on mine timbering than any of the general books on mining contains. Briefly described, the book is made up of eleven papers on mine timbering by different authors, all the papers being reprints from the Engineering and Mining Journal, the Mineral Industry, the Proceedings of the Canadian Mining Institute and the Canadian Society of Civil Engineers. Naturally these papers vary considerably in value, but none of them are unworthy of permanent preservation and some of them are exceedingly valuable contributions to the literature of mining engineering.

The book opens with the paper on "Mine Timbering" contributed to "The Mineral Industry" for 1890 by Mr. Wilbur E. Sanders. It begins with a brief general discussion of the principles of timbering and then discusses in order the various methods of timbering shafts, shaft stations, levels, working places, stopes, etc., closing with a section on methods of framing. Incline and vertical shafts and shafts in loose and in running ground are all considered. The illustrations have been carefully worked up and add materially to the value of the text. The second paper by Mr. Bernard MacDonald is more specific in character; it describes and discusses the square set system of timbering practiced at Rossland, British Columbia. Credit for the invention of the system is given to Philip Deidesheimer, who first used it at the Ophir mine on the Comstock lode in 1860. The practice at Rossland is minutely detailed and general figures of cost are given. In the third paper by Mr. Norman W. Parlee the methods of timbering practiced at the Le Roy and Old Ironsides mines in British Columbia and at the Baltic, Atlantic, Burnam, Queen and other Michigan mines are described and illustrated. The remaining papers are: Mine Timbering in Section 16 of the Lake Superior Mining Co., Michigan, by C. St. G. Campbell; The Framing of Rectangular Shaft Sets by W. E. Sanders; Square Set Practice at Bingham, Utah, by L. S. Cates; Square Set Practice at Bingham, Utah, by C. T. Rice; Mine Timbering at Lake Superior, by W. R. Crane; Timber and Timbering in the Cœur d'Alene, by J. H. Batcheller; Timbering at the Chillagoe Mines, Queensland, by T. J. Greenway, and Timbering in Tasmania, by Mark Weland. The several papers are indexed.

A Series of Papers and Reports on Gas and Electric Light and Power Company Finances.

THE FINANCES OF GAS AND ELECTRIC LIGHT AND POWER ENTERPRISES.—By William D. Marks, Consulting Engineer, Park Row building, New York, N. Y. Published by the author; cloth, 5x7½ ins.; pp. 540; illustrated; $4.00.

This volume is a collection of papers, engineers' reports and documents written at various times and for different purposes, but all relating to the finances of public service corporations. The object of this collection, according to the preface, is to afford those desiring to know the proper prices to be charged for electric railway fares and freight, gas and electricity, a rational and practical method of determining them in whatever locality may be chosen. While the reviewer can hardly agree with the author that this ambitious object is fully attained, the book does contain a large number of useful data on its subject. It is particularly interesting for the effort made to analyze the various conditions and factors determining the cost of production and the amount of consumption that may be anticipated under different local conditions. The author, it may be noticed, writes with the authority of long experience both as a consulting engineer and as the executive head of large public service corporations.

The volume begins with a chapter of some 130 pages on the finances of electric railways. A general discussion of the subject is followed by a series of eight tables giving earnings, operating expenses, traffic and construction costs of a large number of street and interurban electric railways. As a portion of this chapter the author gives in detail the report made by him as consulting engineer for the Palouse & Spokane Electric Ry. to determine the gross earnings in the field served, to fix the conservative capitalization necessary and to estimate the cash cost of the road constructed and operated. Each of these items is worked out in detail and complete specifications are given for track, structures, power plant, transmission line and rolling stock equipment. Chapters II to XI consider cost of production of incandescent electric light, electrical measurements and prices; methods of establishing prices for gas and electricity; finances of district heating from electric plants; how to get paying loads from and overlooked losses in stations; cost of street lighting. Chapters XII and XIII are devoted to gas lighting. A very full analysis is given of the New York city gas companies' operations, including the notorious "gas war" of 1899-00, and a digest of the evidence given in the lawsuit resulting from the reduction of the price of gas in that city to 80 cts. per thousand feet. Accompanying this chapter are diagrams giving the estimated cost of laying gas mains in New York, Buffalo and Indianapolis. Chapter XIV is an attempt "to present in algebraic form every factor required for the proper fixing of railway rates, not only in electric railways but also in steam railways."

An Attempt to Simplify the Six-Chord Spiral Problem.

THE SIX-CHORD SPIRAL.—By J. R. Stephens, Engineering News Pub. Co., New York. Cloth, 5x7 ins.; pp. 68; illustrated.

The title of this book is derived from the principle of laying out the spiral by the aid of six equal arcs the curvature of which begins with a very long radius at the tangent and so arranged that the radii successively decrease uniformly, so that the radius of the seventh arc always equals that of the main circular curve. The mathematical principles involved are clearly demonstrated; they are very simple and require only elementary knowledge of algebra, geometry and trigonometry, and are further elucidated by a number of practical problems and auxiliary tables.

In table II are suggestions as to the length of spirals for various degrees of curvature to which exceptions might be taken, since, for instance, no road would adopt a speed 100 miles per hour on a one-degree curve or 70.7 miles for a two-degree curve as indicated. Again the table would perhaps have been of greater use to the beginner if the lengths of the six chord spirals had been made divisible by 6, as is recommended elsewhere in the book.

Table III is ingeniously reversed from table II to find the most satisfactory speed of trains on a given curve with a given elevation. Such a table would be useful for practical trackmen if it were given in inches instead of feet.

The method shown of staking out the spirals by deflection angles is very simple and should be recommended for that reason. The resulting error is so small that it may be neglected.

The method of spreading old track described in part II is logical and correct, but might have been improved by appending a diagram to show the relation of the various parts.

CONTRACT NEWS

We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Bids Open.		See Issue.
July 31.	Hattiesburg, Miss.	July 10
July 31.	Glencoe, Ill	July 24
Aug. 1.	East St. Louis Ill	July 17
Aug. 1.	Hayes, Kan	July 31
Aug. 1.	Woodland, Cal	July 17
Aug. 1.	Milwaukee, Wis	July 24
Aug. 3.	Ottawa, Ont	July 24
Aug. 3.	Washington C. H., O	July 24
Aug. 3.	Findlay, O	July 24
Aug. 3.	Springfield, Ill	July 31
Aug. 5.	Valparaiso, Ind	July 31
Aug. 3.	Cleveland, O.	July 10
Aug. 5.	Jackson, O.	July 10
Aug. 5.	Rome, Ga	July 17
Aug. 5.	New Bern, N. C	July 17
Aug. 5.	Vicksbury; Miss	July 24
Aug. 5.	Columbus, O	July 24
Aug. 5.	Bluffton, Ind	July 24
Aug. 5.	Newton, Kan	July 24
Aug. 5.	Valparaiso, Ind	July 24
Aug. 5.	Tipton, Ind	July 24
Aug. 5.	Noblesville, Ind	July 24
Aug. 5.	Lebanon, Ind	July 24
Aug. 5.	Crown Point, Ind	July 24
Aug. 5.	Troy, O	July 24
Aug. 5.	Shelbyville, Ind	July 31
Aug. 5.	Preston, Minn	July 31
Aug. 5.	Leavenworth, Kan	July 31
Aug. 5.	Arlington Heights, Ill	July 31
Aug. 6.	Cleveland, O	July 24
Aug. 6.	Brazil, Ind	July 24
Aug. 6.	New Lexington, O	July 24
Aug. 6.	Brownstown, Ind	July 24
Aug. 6.	Covington, Ind	July 17
Aug. 6.	Williamsport, Pa	July 31
Aug. 6.	Marysville, Cal.	July 31
Aug. 6.	Newark, N. J	July 31
Aug. 6.	Rochester, Ind	July 31
Aug. 6.	La Grange, Ind	July 31
Aug. 7.	Chicago, Ill	July 31
Aug. 7.	Decatur, Ind	July 31
Aug. 7.	Anderson, Ind	July 31
Aug. 7.	Alva, Okla	July 31
Aug. 7.	Galena, Ill	July 31
Aug. 7.	Indianapolis, Ind	July 31
Aug. 7.	Warsaw, Ind	July 24
Aug. 7.	Peru, Ind	July 24
Aug. 8.	New Albany, Ind	July 24
Aug. 8.	Zanesville, O	July 24
Aug. 9.	Hamburg, Pa	July 31
Aug. 10.	Cleveland, O	July 17
Aug. 10.	Washington, D. C	July 31
Aug. 12.	Los Angeles, Cal	July 31
Aug. 12.	Mangum, Okla	July 31
Aug. 12.	Mitchell, S. Dak	July 31
Aug. 15.	Mount Gilead, O	July 24
Aug. 15.	Jackson, O	July 24
Aug. 16.	Cincinnati, O	July 24
Aug. 16.	Spokane, Wash	July 31
Aug. 19.	Jefferson, O	July 31
Aug. 20.	San Juan, P. R	July 24
Sept. 2.	Tarboro, N. C	July 31
Sept. 4.	Glasgow, Mont	July 31
Sept. 30.	Santiago, Chile	July 17

Buildings

July 31.	Ravena, N. Y	July 24
July 31.	Owosso, Mich	July 17
July 31.	Washington, D. C	July 17
July 31.	Owosso, Mich.	July 3
Aug. 1.	Washington, D. C	July 10
Aug. 1.	Milwaukee, Wis	July 31
Aug. 1.	Newark, N. J	July 31
Aug. 1.	Lead, S. Dak	July 31
Aug. 1.	Boston, Mass	July 31
Aug. 1.	Bowling Green, Va	July 17
Aug. 1.	New York, N. Y	July 24
Aug. 1.	Houston, Va	July 24
Aug. 1.	Union, Ind	July 24
Aug. 2.	Peoria, Ill	July 31
Aug. 2.	Norwich, Kan	July 31
Aug. 3.	Bucyrus, O	July 31
Aug. 4.	Hannaford, N. Dak	July 17
Aug. 5.	Tallahassee, Fla	July 17
Aug. 5.	Cleveland, O	July 17
Aug. 5.	Crookston, Minn.	July 3
Aug. 5.	New York, N. Y	July 24
Aug. 5.	Leavenworth, Kan	July 24
Aug. 5.	Brooklyn, N. Y	July 31
Aug. 5.	Boston, Mass	July 31
Aug. 5.	Fargo, N. Dak	July 31
Aug. 5.	Aurora, Neb	July 31
Aug. 5.	Richmond, Va	July 31
Aug. 5.	Marshall, N. C	July 31
Aug. 6.	Red Bank, N. J	July 31
Aug. 6.	Waukesha, Wis	July 31
Aug. 6.	Madison, Wis	July 31
Aug. 6.	Shelby, N. C	July 24
Aug. 6.	Columbus, O.	July 10
Aug. 6.	Brooklyn, N. Y	July 17
Aug. 6.	Asheville, N. C	July 17
Aug. 6.	Wabash, Ind	July 17
Aug. 7.	Halifax, N. S	July 17
Aug. 7.	Baltimore, Md	July 24
Aug. 7.	Upper Sandusky, O	July 31
Aug. 8.	Brooklyn, N. Y	July 31
Aug. 9.	Spring City, Pa	July 31
Aug. 9.	Lakewood, O	July 24
Aug. 9.	Lakewood, O	July 17
Aug. 9.	Monticello, Ind.	July 3
Aug. 10.	Brenham, Tex	July 31
Aug. 12.	West Allis, Wis	July 31
Aug. 12.	Grand Junction, Colo	July 31
Aug. 12.	Mason City, Ia.	July 3
Aug. 14.	Springfield Township, O	July 24
Aug. 14.	Washington, D. C	July 31
Aug. 14.	Ionia, Mich	July 31
Aug. 15.	New York, N. Y	July 31
Aug. 15.	Philadelphia, Pa	July 31
Aug. 15.	Stonington, Conn	July 31
Aug. 15.	Albany, N. Y	July 24
Aug. 15.	North Chicago, Ill	July 24
Aug. 15.	Bakersville, N. C	July 17
Aug. 15.	Terre Haute, Ind	July 24
Aug. 17.	Peru, Ind	July 24
Aug. 19.	Alexandria, Minn	July 17
Aug. 20.	Decatur, Ill	July 17
Aug. 20.	Spearfish, S. Dak	July 24
Aug. 20.	Montevallo, Ala	July 24
Aug. 20.	Athens, O	July 31
Aug. 20.	Lumberton, N. C	July 31
Aug. 21.	Fort Dodge, Ia	July 31
Aug. 22.	Jackson, Miss	July 24
Aug. 22.	Jackson, Mich	July 17
Aug. 23.	Delaware, O	July 31
Aug. 24.	Geneva, Ill	July 17
Aug. 27.	Trenton, N. J	July 31
Sept. 3.	Watertown, N. Y	July 31
Sept. 3.	Bloomfield, Ind	July 31
Sept. 4.	Quincy, Mass	July 31

Roads and Streets.

July 31.	Kansas City, Mo	July 10
July 31.	Fort Greble, R. I	July 17
July 31.	Baltimore, Md	July 24
July 31.	Brooklyn, N. Y	July 24
Aug. 1.	Kansas City, Mo	July 24
Aug. 1.	St. Paul, Minn	July 24
Aug. 1.	Brooklyn, N. Y	July 24
Aug. 1.	Frostburg, Md	July 24
Aug. 1.	Rahway, N. J	July 17
Aug. 1.	Greencastle, Ind	July 17
Aug. 1.	Greencastle, Ind.	July 3
Aug. 2.	Cincinnati, O.	July 10
Aug. 2.	Youngstown, O	July 31
Aug. 2.	Rosselle Park, N. J	July 31
Aug. 3.	Youngstown, O	July 31
Aug. 3.	Reading, Ill	July 31
Aug. 3.	St. Clairsville, O	July 17
Aug. 3.	New Bremen, O	July 17
Aug. 3.	Terre Haute, Ind	July 24
Aug. 5.	Columbus, Ind	July 24
Aug. 5.	Plainfield, N. J	July 24
Aug. 5.	Fort Mackenzie, Wyo	July 24
Aug. 5.	Toledo, O	July 24
Aug. 5.	Mount Vernon, Ind	July 24
Aug. 5.	English, Ind	July 24
Aug. 5.	Carlinville, Ill	July 24
Aug. 5.	Montgomery, Ala	July 24
Aug. 5.	Greensburg, Ind	July 17
Aug. 5.	Olympia, Wash	July 17
Aug. 5.	Sullivan, Ind	July 17
Aug. 5.	Boonville, Ind.	July 10
Aug. 5.	Syracuse, N. Y	July 31
Aug. 5.	St. Paul, Minn	July 31
Aug. 5.	Lawrence, Kan	July 31
Aug. 5.	Martinsville, Ind	July 31
Aug. 5.	Chicago, Ill	July 31
Aug. 5.	Burlington, Ia	July 31
Aug. 5.	New Haven, Conn	July 31
Aug. 5.	Indianapolis, Ind	July 31
Aug. 5.	Benton Harbor, Mich	July 31
Aug. 5.	Skowhegan, Me	July 31
Aug. 5.	Somers Point, N. J	July 31
Aug. 5.	Wichita, Kan	July 31
Aug. 5.	Bluffton, Ind	July 31
Aug. 6.	Akron, O	July 31
Aug. 6.	Bellevue, Pa	July 31
Aug. 6.	New York, N. Y	July 31
Aug. 6.	New York, N. Y	July 31
Aug. 6.	New York, N. Y	July 31
Aug. 6.	Omaha, Neb	July 31
Aug. 6.	Barnesville, O	July 31
Aug. 6.	Washington, Ind	July 31
Aug. 6.	Newcastle, Ind	July 31
Aug. 6.	Martinsville, Ind	July 31
Aug. 6.	Chicago, Ill	July 31
Aug. 6.	Sharpsville, Pa.	July 10
Aug. 6.	Sewickley, Pa	July 24
Aug. 6.	Edgewater, N. J	July 24
Aug. 6.	Washington, Pa	July 24
Aug. 6.	Napoleon, O	July 24
Aug. 6.	Spencer, Ind	July 24
Aug. 6.	Covington, Ind	July 24
Aug. 7.	Rockville, Ind	July 24
Aug. 7.	Peru, Ind	July 24
Aug. 7.	Des Moines, Ia	July 24
Aug. 7.	Toledo, O	July 31
Aug. 8.	Cleveland, O	July 31
Aug. 8.	Brooklyn, N. Y	July 31
Aug. 8.	Hookset, N. H	July 31
Aug. 8.	Riverton, N. J	July 31
Aug. 8.	Concord, N. H	July 31
Aug. 8.	Brooklyn, N. Y	July 31
Aug. 8.	New York, N. Y	July 31
Aug. 8.	St. Paul, Minn	July 31
Aug. 8.	Brooklyn, N. Y	July 31
Aug. 8.	Hartford City, Ind	July 31
Aug. 9.	Des Moines, Ia	July 31
Aug. 9.	Valparaiso, Ind	July 31
Aug. 9.	Monessen, Pa	July 24
Aug. 10.	Bellevue, O	July 31
Aug. 10.	Covington, Ind	July 31
Aug. 10.	Hardin, Ill	July 31
Aug. 10.	Scottville, Mich	July 31
Aug. 10.	Struthers, O	July 24
Aug. 10.	Lisbon, O	July 24
Aug. 10.	Findlay, O	July 24
Aug. 10.	Celina, O	July 24
Aug. 12.	Cedar Rapids, Ia	July 31
Aug. 12.	Cincinnati, O	July 31
Aug. 13.	Huntington, Ind	July 24
Aug. 15.	Elizabeth, N. J	July 31
Aug. 17.	Huntsville, Ala	July 31
Aug. 17.	Cleveland, O	July 24
Aug. 20.	Cleveland Heights, O	July 24
Aug. 20.	Cleveland Heights, O	July 24
Aug. 24.	Prescott, Ariz	July 31
Aug. 27.	Pensacola, Fla	July 31
Aug. 28.	Hoboken, N. J	July 31
Aug. 30.	Marshfield, Mo	July 31

Sewers.

July 31.	North Battleford, Sask.	July 3
July 31	Brooklyn, N. Y	July 24
Aug. 1.	Kansas City, Mo	July 24
Aug 1	Bloomfield, N. J	July 24
Aug. 1.	Scottdale, Pa	July 24
Aug. 1.	St. Joseph, Mo	July 31
Aug. 1.	New Haven, Conn	July 31
Aug. 1.	Jamestown, N. Y	July 17
Aug. 1.	Chewelah, Wis	July 24
Aug. 2.	Withee, Wis	July 24

Aug. 2. Amsterdam, N. Y....July 31
Aug. 2. Lima, O....July 31
Aug. 2. Elyria, O....July 31
Aug. 2. Youngstown, O....July 24
Aug. 3. Westfield, Mass....July 31
Aug. 5. River Forest, Ill....July 31
Aug. 3. New Bremen, O....July 17
Aug. 5. Grand Forks, N. Dak....July 17
Aug. 5. Plainfield, N. J....July 17
Aug. 5. North Milwaukee, Wis....July 17
Aug. 5. Waukesha, Wis....July 31
Aug. 5. Sparta, Wis....July 31
Aug. 5. Chester, Pa....July 31
Aug. 5. Westfield, N. J....July 31
Aug. 5. Omaha, Neb....July 31
Aug. 5. Helena, Mont....July 31
Aug. 5. Sedalia, Mo....July 31
Aug. 5. St. Paul, Minn....July 31
Aug. 5. Sioux Falls, S. D....July 31
Aug. 5. Columbus, Ind....July 31
Aug. 5. Helena, Mont....July 31
Aug. 5. Burlington, Ia....July 31
Aug. 5. Thayer, Ill....July 24
Aug. 5. Decorah, Ia....July 17
Aug. 5. Fort Adams, R. I....July 17
Aug. 6. Davenport, Ia....July 31
Aug. 6. New York, N. Y....July 31
Aug. 6. New York, N. Y....July 31
Aug. 6. Grinnell, Ia....July 31
Aug. 6. Taylor, Pa....July 31
Aug. 6. Akron, O....July 31
Aug. 6. Cherokee, Ia....July 17
Aug. 6. Alexandria, La....July
Aug. 6. McKeesport, Pa....July 24
Aug. 7. Chicago, Ill....July 31
Aug. 7. Denver, Colo....July 31
Aug. 7. Steelton, Pa....July 17
Aug. 8. Fort Oglethorpe, Ga....July 17
Aug. 8. Bloomfield, Ind....July 17
Aug. 8. St. Paul, Minn....July 31
Aug. 8. Green Bay, Wis....July 31
Aug. 12. Madison, S. Dak....July 31
Aug. 12. Willmar, Minn....July 24
Aug. 12. Marshfield, Wis....July 24
Aug. 13. Lincoln, Cal....July 31
Aug. 14. Oakland, Cal....July 31
Aug. 14. Boise, Idaho....July 31
Aug. 15. Arkadelphia, Ark....July 31
Aug. 15. Elizabeth, N. J....July 31
Aug. 15. Camden, Ark....July 24
Aug. 19. Port Clinton, O....July 24
Aug. 19. Cape Girardeau, Mo....July 31
Aug. 20. Collinsville, Ill....July 31
Aug. 20. Cleveland Heights, O....July 24
Aug. 21. North Chicago, Ill....July 31
Aug. 22. Fayetteville, Ark....July 24
Aug. 23. Delaware, O....July 31
Aug. 30. Evansville, Ind....July 24
Sept. 11. New Orleans, La....July 10

Water Supply.

Aug. 3. Chesterton, Ind....July 31
Aug. 3. Newark, Del....July 31
Aug. 5. Kenyon, Minn....July 31
Aug. 7. Chicago, Ill....July 31
Aug. 8. New York, N. Y....July 31
Aug. 8. Bonesteel, S. Dak....July 31
Aug. 9. Fort Hancock, N. J....July 17
Aug. 12. Belle Plaine, Minn....July 24
Aug. 13. Columbus, O....July 17
Aug. 19. Sacramento, Cal....June 5
Aug. 19. Lombard, Ill....July 31
Aug. 20. Russellville, Ark....July 24
Aug. 21. Springfield, Mass....July 31
Aug. 21. Fort Hancock, N. J....July 31
Aug. 22. Philadelphia, Pa....July 31
Aug. 27. Cincinnati, O....July 31
Sept. 4. New Orleans, La....July 3

Miscellaneous.

July 31. Tacoma, Wash.
Power Plant, July 17
Aug. 1. Washington, D. C.,
Torpedo Boats, June 5
Aug. 1. New York, N. Y.,
Greenhouse, July 24
Aug. 1. Brooklyn, N. Y.,
Refuse Disposal, July 24
Aug. 2. Racine, Wis.,
Breakwaters, July 10
Aug. 2. Youngstown, O.,
Hauling Pipe, July 31
Aug. 3. Jackson Barracks, La.
Wharf Repairs, July 17
Aug. 3. San Juan, R. I.,
Pier Repairs, June 26
Aug. 5. Harrisburg, Pa.,
Garbage Disposal, June 26
Aug. 5. Somers Point, N. J.,
Wharf, Grading, July 24
Aug. 5. Boston, Mass.,
Conduit, July 24
Aug. 5. Fort Adams, R. I.,
Wire Fence, July 24
Aug. 6. Mount Vernon, Ind.,
Concrete Dam, July 24
Aug. 6. Cleveland Heights, O.,
Street Lighting, July 10
Aug. 6. New York, N. Y.,
Dams, July 10
Aug. 6. New York, N. Y.,
Pier, July 31
Aug. 7. Brooklyn, N. Y.,
Crib Bulkhead, July 31
Aug. 8. Cleveland, O.,
Power House Superstructure, July 31
Aug. 8. Fort Omaha, Neb.,
Gas House, Etc., July 24
Aug. 9. Hadley, Mass.,
Riprap, July 31
Aug. 10. Hickory, N. C.,
Dam, Power Plant, Etc., July 31
Aug. 10. Santa Barbara, Cal.,
Bulkhead, July 31
Aug. 12. New York, N. Y.,
Tunnel, July 31
Aug. 12. Brownsville, Pa.
Lock, Walls, Etc., July 17
Aug. 13. New York, N. Y.,
Freight Sheds, July 31
Aug. 14. Oakland, Cal.,
Street Sweeping, July 31
Aug. 14. Key West, Fla.,
Breakwater, July 31
Aug. 15. Boston, Mass.,
Subway Entrance, July 31
Aug. 16. Galveston, Tex.,
Jetty Work, July 24
Aug. 19. Washington, D. C.,
Steam Vessel, July 24
Aug. 20. San Diego, Cal.,
Wharf and Trestle, June 26
Aug. 24. Bremerton, Wash.,
Concrete Quay Wall, July 24
Aug. 24. Toledo, O.,
Monument, July 31
Aug. 27. Cincinnati, O.,
Tracks, Grading, Etc., July 31
Aug. 31. Lebanon, Pa.,
Street Lighting, July 24
Sept. 1. Webb City, Mo.,
Railroad, July 31
Sept. 3. Winnipeg, Man.,
Hydro-Electric Development, June 19

Excavation, Earth and Rock.

July 31. Albany, N. Y.,
Barge Canal Work, July 10
July 31. Galveston, Tex.,
Dredging, July 10
July 31. Piper City, Ill.,
Ditch Work, July 24
Aug. 1. New York, N. Y.,
Grading, July 24
Aug. 1. Marshalltown, Ia.,
Drainage Ditch, July 10
Aug. 1. Emmetsburg, Ia.,
Drainage Work, July 3
Aug. 1. Nevada, Ia.,
Ditch Work, July 3
Aug. 1. Milner, Idaho.
Irrigation Canal, July 17
Aug. 2. New Orleans, La.,
Levee Work, July 31
Aug. 2. Nevada, Ia.
Ditch Work, July 17
Aug. 2. Hooppole, Ill.,
Ditch Work, July 24
Aug. 5. Sullivan, Ind.,
Ditch Work, July 24
Aug. 5. Wilmington, Del.
Dredging, July 24
Aug. 5. Greenfield, Ind.
Ditch Work, July 17
Aug. 5, Arkansas City, Ark.,
Drainage Ditches, July 31
Aug. 6. Newton, Ia.
Ditch Work, July 17
Aug. 6. Pocahontas, Ia.
Drainage Work, July 17
Aug. 7. Mason City, Ia.,
Tile Drains, July 31
Aug. 7. San Juan, P. R.,
Dredging, July 3
Aug. 10. Portsmouth, N. H.,
Filling, July 24
Aug. 10. Aztec, N. Mex.,
Irrigation Canal, July 31
Aug. 12. Philadelphia, Pa.,
Dredging, July 24
Aug. 12. Washington, D. C.,
Dredging, July 24
Aug. 12 Norwalk, Conn.
Dredging, July 17
Aug. 15. Cheboygan, Mich.,
Dredging, July 24
Aug. 16. Tampa, Fla.,
Dredging, July 24
Aug. 19. New London, Conn.,
Dredging, July 31
Aug. 22. Brunswick, Ga.,
Dredging, July 24
Aug. 23, Savannah, Ga.,
Dredging, July 31
Aug. 26. Fort Washington, Md.,
Grading, Draining, July 31
Aug. 26. New York, N. Y.,
Embankment, July 31
Sept. 10. Sibley, Ia.,
Ditch Work, July 31

Materials, Machines, Supplies, Tools Etc

July 31. Washington, D. C.
Steel Shelving, July 17
July 31. New York, N. Y.,
Ice Making Plant, July 24
July 31. Washington, D. C.,
Radiators, July 24
Aug. 1. New York, N. Y.,
Broken Stone, July 24
Aug. 1. St. Paul, Minn.,
Street Signs, July 27
Aug. 2. Washington, D. C.,
Dump Cars, July 24
Aug. 3. Williamsport, Pa.,
Paving Machinery, July 24
Aug. 3. Norwood, O.,
Water Meters, July 24
Aug. 5, Cleveland, O.,
Oak Lumber, July 31
Aug. 6, Norfolk, Va.,
Lathe, Cement, Etc., July 31
Aug. 6, New York, N. Y.,
Road Rollers, July 31
Aug. 6. Boston, Mass.,
Blueprint Paper, Filing Cabinets, Etc....July 31
Aug. 6. Pensacola, Fla.,
Fire Engines, Flat Cars, July 31
Aug. 6. Washington, D. C.,
Tank, Emery Wheels, Etc., July 31
Aug. 6. Puget Sound, Wash.,
Pipe, Cement, Chain, Etc., July 24
Aug. 6. Mare Island, Cal.,
Wire, Steel, July 24
Aug. 6. Millvale, Pa.,
Fire Hose, July 24
Aug. 7. New York, N. Y.,
Motor Generator Sets, Etc., July 31
Aug. 8, Cleveland, O.,
Boiler, Superheater, Etc., July 31
Aug. 8. Cleveland, O.,
Meter Manhole Rings, July 31

Aug. 8. Washington, D. C., Rails, Ties, Piles, Etc., July 24
Aug. 9, Washington, D. C., Pipe, Valves, Etc., July 31
Aug. 10, Huntsville, Ala., Sewer Pipe, Brick, July 31
Aug. 10. Portsmouth, N. H. Elevator, July 17
Aug. 12, Washington, D. C., Steel Dump Barges, July 31
Aug. 13, New York, N. Y., Pipe, Electrical Supplies, Etc., July 31
Aug. 13, Portsmouth, N. H., Barrows, Shovels, Pike, Etc. July 31
Aug. 13, Boston, Mass., Boring Machines, Etc., July 31
Aug. 13, New Orleans, La., Tile Drain Pipe, July 31
Aug. 13, Pensacola, Fla., Timber, Brick, Cement, Etc., July 31
Aug. 13, Washington, D. C., Navigator's Supplies, Drills, Etc., July 31
Aug. 14, Washington, D. C., Track Scales, Tanks, Etc., July 31
Aug. 14, Washington, D. C., Elevators, July 31
Aug. 14. Wheeling, W. Va., Iron and Steel, July 24
Aug. 16. Chicago, Ill., Machinery, July 24
Aug. 20, Mare Island, Cal., Brick, Timber, Etc., July 31
Aug. 21, Tompkinsville, N. Y., Moorings, July 31
Sept. 8, Louisville, Ky., Pumping Engines, July 31
Sept. 14. Manila, P. I., Valves, Gates, July 31

BIDS ASKED.

Bridges.

Items Arranged Alphabetically by States.

Los Angeles, Cal.—Bids are asked by County Supervisors, C. G. Keyes, Clerk, until 2 p. m., Aug. 12, for furnishing all labor and materials necessary for the construction of two concrete abutments and the erection of a timber bridge on said abutments, across San Dimas Wash, on Azusa Ave., in the Azusa Road District.

Marysville, Cal.—Bids are asked by County Supervisors, Gordon Bowman, Clerk, until Aug. 6, for construction of a steel truss bridge over Dry Creek on Camptonville Road.

Washington, D. C.—Bids are asked by District Commissioners, until noon, Aug. 10, for the construction of a concrete-steel bridge across the track of the Baltimore & Ohio R. R., on the line of Monroe St., Brookland, D. C.

Arlington Height, Ill.—Bids will be received at Cook county Commissioners' Rooms, 218 La Salle St., Chicago, until noon, Aug. 5, for the construction of a 20-ft. reinforced concrete culvert, on a road between Sections 28 and 33, in the Township of Wheeling. Plans and specifications are on file at the office of Julius Fientye, Town Clerk, Arlington Heights, and at the office of H. L. Emerson, Engineer, Room 1206, Chamber Commerce Bldg., Chicago, Ill.

Chicago, Ill.—Bids are asked by John J. Hanberg, Commissioner Public Works, until 11 a. m., Aug. 7, for labor and material for construction and erection of the substructure for a drawbridge over the west arm of the south fork of the south branch of the Chicago River at South Ashland Ave. Bids are also asked for the labor and material for erection of superstructure of above bridges. Plans, etc., on file in Room 326, City Hall.

Galena, Ill.—County Bridge Committee, John Laird, Chairman, and the Commissioners of Highways of the town of Guilford will meet at 10 a. m., Aug. 7, at the old bridge in front of Simon Distler's farm, 1½ miles south of Scales Mound, for the purpose of letting a contract for a new bridge and repairing one other at the estimated cost of $1,200.

Springfield, Ill.—Local reports state that bids will be received by the Commissioners of the town of Francy Creek, County of Sangamon, until Aug. 3, for building one steel bridge. John Brennan is Town Clerk.

Anderson, Ind.—Bids are asked by Commissioners of Madison County until Aug. 7, for the repair of the bridge on East Ninth St. Jos. D. Kinnard, Auditor.

Decatur, Ind.—Bids are asked by Commissioners of Adams County, until 10 a. m., Aug. 7, for construction of G. W. Reynolds bridge on Jay County line, 30 by 16-ft. span, also concrete abutments at same place. C. D. Lewton is County Auditor.

Indianapolis, Ind.—Bids are asked by Commissioners of Madison County at Indianapolis, until 10 a. m., Aug. 7, for the construction of seven culverts and three bridges.

Rochester, Ind.—Bids are asked by Commissioners of Fulton County, at Rochester, until 2 p. m., Aug. 6, for the construction of a steel arch.

La Grange, Ind.—Bids are asked by Commissioners of La Grange County, at La Grange, until noon, Aug. 6, for the construction of the McManus arch across Preston ditch, Lima Township.

Shelbyville, Ind.—Bids are asked by Commissioners of Shelby County, until 10 a. m., Aug. 5, for construction of a 75-ft. reinforced concrete arch, over Little Sugar Creek, in Moral Township, about 2½ miles north of Fairyland. Bids are also asked for repair of seven bridges. Thomas Hawkins is County Auditor.

Valparaiso, Ind.—Bids are asked by Commissioners of Porter County, until noon, Aug. 5, for construction of three bridges.

Leavenworth, Kan.—Bids are asked by J. W. Niehaus, County Clerk, until Aug. 5, for taking down, repairing and re-erecting bridge at ice house, Tonganoxie.

Hays, Kan.—Bids are reported asked by C. A. Harkness, City Clerk, until noon, Aug. 1, for constructing bridge on Chestnut St., Hays City.

Preston, Minn.—Bids are asked until Aug. 5, for constructing stone arch bridge on Preston-Harmony Road. E. B. Read is Town Clerk.

Glasgow, Mont.—Bids are asked by W. B. Shoemaker, County Clerk, until 2 p. m., Sept. 4, for the construction of a 150-ft. span combination tubular pier bridge 16 ft. road way, 80-ft. approach at one end, across Rock Creek, about 4 miles north of Hinsdale, Valley County.

Tarboro, N. C.—Bids are asked by J. W. B. Battle, Chairman of Commissioners for Edgecombe County, until Sept. 2, for the construction of a steel bridge across Tar River, near Tarboro, 18 ft. wide, 200 ft. long, with 60-ft. draw.

Newark, N. J.—Bids are asked by G. F. Drum, County Engineer, Room 312, Court House, Newark, until 2 p. m., Aug. 6, for construction of bridge on West Turner Ave., village of South Orange; also bridge on Union St., in township of Montclair.

Jefferson, O.—Bids are asked by County Auditor, until Aug. 19, for the construction of a reinforced concrete bridge in Gates St., Andover Village.

Alva, Okla.—Bids are asked by H. P. Cunningham, County Clerk, until 10 a. m., Aug. 7, for the construction of 18 bridges in Woods County.

Mangum, Okla.—Bids are asked by Commissioners of Greer County, until Aug. 12, for the erection of a wagon bridge across Elm Fork of Red River 3 miles north of Mangum. Floyd McNeill is County Clerk.

Hamburg, Pa.—Bids are asked by H. F. Livingood, County Controller, Reading, Pa., until 10 a. m., Aug. 9, for the erection of a reinforced concrete arch bridge in the borough of Hamburg. Bridge is to have a 40-ft. clear span, having a rise of 8 ft., with two abutments and four wing walls and all surmounted with a parapet wall over the entire length on each side.

Williamsport, Pa.—Bids are asked by Commissioners of Lycoming County, until noon, Aug. 6, for the rebuilding of the abutments of the highway bridge across Lycoming Creek at Powys Station. Certified check for $200 required with bid. Frank L. Miller is County Clerk.

Mitchell, S. Dak.—Bids are asked by H. B. Anderson, County Auditor, until Aug. 12, for construction of the following bridges: A 60-ft. steel bridge; a truss pile bridge, 30 ft. long; a pile bridge in Union Township; steel bridge, 50 ft. long; truss pile bridge, in Tobin Township; truss pile bridge in Baker Township.

Fort Myer, Va.—Bids are asked by Mayor M. Gray Zalinski, Q. M., General Depot of Q. M. Department, Washington, D. C., until 11 a. m., Aug. 20, for constructing bridge on Military road to Fort Myer, Va.

Spokane, Wash.—Bids are asked by State Highway Board, Joseph M. Snow, Secretary, Olympia, Wash., until 2 p. m., Aug. 16, for sub and superstructure of bridge over Methow River on State Road No. 10. Bowerman & McClay, Consulting Engineers, New York Block, Seattle, Wash.

Buildings.

Items Arranged Alphabetically by States.

Grand Junction, Colo.—Bids are asked by J. B. Boyer, Architect, Grand Junction, Colo., until noon, Aug. 12, for all labor and materials required by the plans and specifications, for the erection and completion of a 3-story basement and roof garden brick, stone and concrete Elks' Temple to be erected at Grand Junction.

Stonington, Conn.—Bids are asked by Light House Engineer, Tompkinsville, N. Y., until 1 p. m., Aug. 15, for erecting keeper's dwelling at Stonington Breakwater light station, Conn.

Washington, D. C.—Bids are asked by Col. F. L. Denny, Q. M., Marine Corps, until 10 a. m., Aug. 14, for completing Marine Barracks and officers' quarters, etc., Washington, D. C.

Peoria, Ill.—Bids are asked by Board of School Inspectors, until Aug. 2, for new wing for high school at Monroe and Fayette Sts.

Bloomfield, Ind.—Bids are asked by the County Auditor, until 2 p. m., Sept. 3, for the furnishing of all materials and labor necessary for the erection and completion of a new cell house and cell work for the Green County Jail. J. W. Gaddis, Architect, Vincennes, Ind.

Fort Dodge, Ia.—Bids are asked by J. B. Butler, until Aug. 21, for the erection and rebuilding of the high school building at Fort Dodge.

Norwich, Kan.—Bids are asked by G. F. Washburn, Clerk, until Aug. 2, for the erection and completion of a 2-room brick school building.

Boston, Mass.—Bids are asked by School House Commissioners, 120 Boyleston St., until noon, Aug. 1, for erecting and completing Manual Training School, Quincy District, Tyler St., Boston.

Boston, Mass.—Bids are asked by George H. M. Rowe, Superintendent Boston City Hospital, until noon, Aug. 5, for building an addition to the Pump Room of the Power Station, No. 750 Albany St. Plans at the office of Densmore & LeClear, Engineers, 15 Exchange St., Boston.

Quincy, Mass.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Sept. 4, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Postoffice and Custom House at Quincy, Mass.

Ionia, Mich.—Bids are asked by H. J. Holbrook, County Clerk, Ionia, until noon, Aug. 14, for the erection of a county house for Ionia County., Plans, specifications and schedules can be obtained from office of Edwyn A. Bowd, Architect, Lansing, Mich.

Aurora, Neb.—Bids are asked by Frank A. Burt, Secretary Board of Education, until Aug. 5, for the erection of a 2-story brick school building.

Newark, N. J.—Bids are asked by R. D. Argue, Secretary Board of Education, until 8:30 p. m., Aug. 1, for furnishing the material and performing the mason and fireproofing work required in the erection of an addition to the Burnet St. School House, etc. Plans in the office of the Architect, Frank F. Ward, 239 Roseville Ave., Newark, N. J.

Red Bank, N. J.—Bids are asked by S. I. Kimball, General Superintendent, U. S. Life Saving Service, Washington, D. C., until 2 p. m., Aug. 6, for making repairs, alterations and additions to Cedar Creek and Forked River (N. J.) life saving stations.

Trenton, N. J.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Aug. 27, for the construction (including heating apparatus, electric wiring and conduits) of the extension to the U. S. Postoffice and Court House at Trenton, N. J.

Brooklyn, N. Y.—Bids are asked by Park Board, Moses Herrman, President, New York, until 8 p. m., Aug. 8, for labor and materials for the following work: Erection of a shelter house in New Lots Park, Borough of Brooklyn, security required is $3,500; erection of a shelter house in Fulton Park, Borough of Brooklyn, security required is $5,000; erection of a shelter house in Winthrop Park, Borough of Brooklyn, security required is $10,000; erection of a shelter and tennis house in Prospect Park, Borough of Brooklyn, security required is $25,000. Blank forms may be obtained and plans may be seen at the office of the Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn.

Brookyln, N. Y.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., New York, until 3 p. m., Aug. 15, for item 1, installing heating apparatus, and item 2, installing electric elevators, in the office and storage building for the Board of Education, on north side of Livingston St., east of Red Hook Lane, and the east side of Red Hook Lane, north of Livingston St., borough of Brooklyn. Security required is $4,000 for each item. Bids are also asked for installing electric equipment of addition to and alterations in public school 129, north side of Gates Ave., 275 feet west of Stuyvesant Ave., borough of Brooklyn. Security required is $3,000

New York, N. Y.—Bids are asked by Robert W. Hebberd, Commissioner of Charities, foot of E. 26th St., until 2:30 p. m., Aug 15, for all materials and labor required for the complete conduiting, electric wiring, and all other work in connection with the installation of a complete electric lighting and power system for all the jurisdiction of the department of public charities, and comprising the city hospital district, Blackwell's Island, Borough of Manhattan, the City of New York. Security required will be $20,000. Drawings, etc., with Raymond F. Almirall, Architect, 51 Chambers St., New York.

Watertown, N. Y.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Sept. 3, for the construction (complete) of the U. S. Postoffice at Watertown, N. Y.

Lumberton, N. C.—Bids are asked by Commissioners of Robeson County, D. W. Bullock, Clerk, until noon, Aug. 20, for the erection, completion and furnishing a new Court House in the town of Lumberton, according to plans and specifications prepared by Frank P. Milburn & Co., Architects, of Washington, D. C. Certified check for $1,000 required with bid.

Marshall, N. C.—Bids are asked by Commissioners of Madison County, Marshall, until noon Aug. 5, for the erection of a Court House according to plans and specifications prepared by Smith & Carrier, Architects, Asheville, N. C. Certified check for $500 required with bid.

Fargo, N. Dak.—Bids are asked by John G. Beusch, City Auditor, until Aug. 5, for the construction of a brick city hall and fire station.

Athens, O.—Bids are asked by Dr. J. T. Hanson, Secretary Board of Trustees Athens State Hospital until noon, Aug. 20, for furnishing the materials and performing the labor for an addition and alterations in the main building at the Athens State Hospital, according to plans, etc., on file at the office of Dr. J. T. Hanson, Superintendent of the Athens State Hospital, and at the office of Frank L. Packard, Architect, Columbus.

Upper Sandusky, O.—Bids are asked by Robert Lindsey, Clerk Board Education, until Aug. 7, for building a school house.

Bucyrus, O.—Bids are asked by Board of Education until Aug. 3, for furnishing all the labor and materials required for the construction of a modern school building.

Delaware, O.—Bids will be received by the Board of Trustees of the Girls' Industrial Home, T. F. Dye, Secretary, until noon, Aug. 23, at the office of Marriott & Allen, Architects, 420 Hayden Clinton Bank Bldg., Columbus, O., for bids on furnishing all labor and materials required to complete all branches of the work and all items which were omitted in the letting of the general contract for the building of the industrial and technical building at Girls' Industrial Home, Delaware, under date of April 16, 1907. Bids will also be received at same time and place for rebuilding Cottage No. 2 at Girls' Industrial Home.

Philadelphia, Pa.—Bids are asked by Col. F. L. Denny, Q. M., U. S. M. C., Washington, D. C., until 10 a. m., Aug. 15, for the construction of an addition to the Philadelphia Depot, 1100 South Broad St., Philadelphia.

Spring City, Pa.—Bids are asked by J. F. Sherwood, Secretary Commission, until noon, Aug. 9, for erection of an Institute near Spring City, Pa., for feeble-minded and epileptics. Plans and specifications, showing location, etc., at office of Architect, Philip N. Johnson, 1825 Land Title Bldg., Philadelphia, Pa.

Lead, S. Dak.—Bids are asked by Carrie M. Voight, Clerk Board Education, until 7 p. m., Aug. 1, for the furnishing and installation of complete blast steam heating and ventilating plants, with central boiler plant, for its High School and Assembly Hall buildings.

Brenham, Tex.—Bids are asked until Aug. 10, for the erection of a brick school building at this city. Wr. Lusk is Mayor.

Richmond, Va.—Bids are asked by Fairfield School Board until noon, Aug. 5, at the office of Charles M. Robinson, School Architect, Tenth and Main Sts, Richmond, Va., where plans and specifications may be seen for work as follows: For one school building to be erected at Highland Springs, and the other on the Mechanicsville turnpike, opposite the toll gate. All bids must be accompanied by a certified check for $200.

Madison, Wis.—Bids are asked by State Board of Control, Capitol Building, Madison, until noon, Aug. 6, for the erection of a stable and laundry building upon the grounds of the Wisconsin State Tuberculosis Sanatorium, situated about 2 miles north of the village of Wales, Wis., in accordance with the plans and specifications prepared for the same by Howland Russel, Architect, Hathaway Bldg., Milwaukee, Wis.

Waukesha, Wis.—Bids are asked by State Board of Control, Capitol Building, Madison, until noon, Aug. 6, for the erection of a building at the Industrial School for Boys, Waukesha, according to the plans and specifications for said work prepared by Ferry & Clas, Architects, Milwaukee, Wis.

Milwaukee, Wis.—Bids are asked by Board of School Directors, Frank M. Harbach, Secretary, until 5 p. m., Aug. 1, for the installation of a new boiler plant and some new piping and radiation in the Third District School, located at Detroit and Jackson Sts.

West Allis, Wis.—Bids are asked by Board Public Works, F. Phillips, Jr., Chairman, until noon, Aug. 12, for construction of a school house in the First ward of West Allis, and installing a heating and ventilating system therein.

Roads and Streets

Items Arranged Alphabetically by States.

Huntsville, Ala.—Bids are asked by the Mayor, until Aug. 17, for constructing vitrified brick pavement in streets bounding Public Square.

Prescott, Ariz.—Bids are asked by Capt. Chas. C. Walcott, Jr., Constructing Q. M., until 11 a. m., Aug. 24, for construction of roads and walks at Whipple Barracks.

New Haven, Conn.—Bids are asked by C. W. Kelly, City Engineer, until 11 a. m., Aug. 5, for paving with crushed stone and Belgian block gutters, Prospect St. from Sachem St. to Grove St.; Sachem St. from Whitney Ave. to Winchester Ave.; and Plymouth St. from Lamberton St. to the Boulevard.

Pensacola, Fla.—Bids are asked by L. Hilton Green, Chairman Board Trustees, until noon, Aug. 27, for constructing approximately 170,700 sq. yds. of clay or shale block, asphalt, bitulithic, wood block or macadam pavement and 115,950 lin. ft. of concrete curb. T. Chalkley Hatton, Chief Engineer, Wilmington, Del., and Pensacola, Fla.

Chicago, Ill.—Bids are asked by Board Local Improvements, E. Orris Hart, Assistant Secretary, until 10:15 a. m., Aug. 5, for repairing brick, asphalt and granite block pavements on sundry streets, according to specifications on file in the office of the Board of Local Improvements, Room 207 City Hall.

Chicago, Ill.—Bids are asked by John J. Hanberg, Commissioner Public Works, until 11 p. m., Aug. 6, for paving with macadam pavement, Peterson Ave., from 40th Ave. to West Bryn Mawr Ave., West Bryn Mawr Ave. from Peterson Ave. to Forest Glen Ave., and Forest Glen Ave. from

West Bryn Mawr Ave. to N. 48th Ave.; also paving with macadam pavement Peterson Ave. from West Ravenswood Park to Western Ave., and for paving with macadam pavement, N. 48th Ave. from Lawrence Ave. to Forest Glen Ave., all according to plans and specifications on file in the office of the Department of Public Works Room 225, City Hall.

Hardin, Ill.—Bids are asked by A. B. Campbell, Village Clerk, until 7 p. m., Aug. 10, for building 12,000 sq. ft. or more of granitoid sidewalks in said village.

Reading, Ill.—Bids are asked by Township Highway Commissioner C. A. Hepler, Ancona, Ill., until 10 a. m., Aug. 3, for graveling Bloomington St. Specifications on file at office of Town Clerk at Ancona, Ill.

Bluffton, Ind.—Bids are asked by Frank S. Smith, City Clerk, until 7:30 p. m., Aug. 5, for construction of cement combined curbs and sidewalks in West Central Ave.

Covington, Ind.—Bids are asked by Commissioners of Fountain County, until 1:30 p. m., Aug. 10, for the construction of a gravel road in Mill Creek Township, 2¼ miles in length. Wm. B. Gray is County Auditor.

Hartford City, Ind.—Bids are asked by Commissioners of Blackford County, until 10 a. m., Aug. 8, for constructing Neal macadam road, ½ mile long, in Harrison. L. W. Daugherty is County Auditor.

Indianapolis, Ind.—Bids are asked by Board Public Works, until 10 a. m., Aug. 5, for improvements of portions of following streets by grading and paving: Harrison St., Bismarck St., Norwood St., Ruckle St., 18th St., 15th St., Montcalm St., Dearborn St., North St., and Michigan St.

Martinsville, Ind.—Bids are asked by Commissioners of Morgan County, at Martinsville, until Aug. 5, for the completion of the Madison gravel road in Ashland Township. B. E. Thornburg is County Auditor.

Martinsville, Ind.—Bids are asked by Commissioners of Morgan County, until Aug. 6, for the construction of one main and one branch gravel road one mile and 4,709 ft. and 2 miles and 320 ft. in length, respectively. B. E. Thornburg is County Auditor.

Newcastle, Ind.—Bids are asked by City Trustees, until 8 p. m., Aug. 6, for construction of cement walks and gravel roadways on three streets.

Valporaiso, Ind.—Bids are asked by Robert B. Ewing, City Clerk, until 8 p. m., Aug. 9, for improvement of part of Erie St., by grading, draining and paving. Bids are also asked for several sidewalk improvements.

Washington, Ind.—Bids are asked by Commissioners of Daviess County at Washington, until 2 p. m., Aug. 6, for the construction of four gravel roads.

Burlington, Ia.—Bids are askeds by City Clerk, until 4 p. m., Aug. 5, for grading and paving with vitrified brick on concrete foundation as follows: Alley No. 2, certified check for $200; Alley east of Central Ave., certified check for $200; Alley No. 9, certified check for $200; Marshall and Division Sts., certified check for $700; Alley No. 8, certified check for $200. J. F. Winters, City Engineer.

Cedor Rapids, Ia.—Bids are asked by J. M. Inhold, Secretary, until 8 p. m., Aug. 12, for 1,000 lin. ft. of curbing and 2,500 sq. ft. of cement sidewalk at the Van Buren and Harrison Schools.

Des Moines, Ia.—Bids are asked by Board Public Works, until 11 a. m., Aug. 9, for the following work: Paving W. 8th St., with vitrified blocks, 1,363 sq. yds.; grading E. 18th St., 11,000 cu. yds.; grading W. 10th St., 3,075 cu. yds.

Lawrence, Kan.—Bids are asked by F. D. Brooks, City Clerk, until 5 p. m., Aug. 5, for grading, curbing and paving with vitrified brick as follows: Kentucky St., 2,000 sq. yds., 2-course paving; Hancock St., 300 sq. yds., 2-course paving; alley between Massachusetts, New Hampshire, Winthrop and Henry Sts., 1,067 sq. yds. paving on old stone foundation.

Wichita, Kan.—Bids are asked by R. N. Dorr, City Clerk, until 5 p. m., Aug. 5, for paving four alleys with vitrified brick. Bids are also asked for paving 9th St. with asphalt, the work including 680 cu. yds. earth excavation and 2,700 sq. yds. of pavement.

Skowhegan, Me.—Bids are asked by Commissioners of Somerset County, until 11 a. m., Aug. 5, for constructing highway from The Forks to Lake Moxie Station.

Benton Harbor, Mich.—Bids are asked by A. H. Buger, City Clerk, until 8 p. m., Aug. 5, for paving with brick portions of Stevens and Green Aves. Certified check for $500 with bid.

Scottville, Mich.—Bids are asked by W. C. Freedy, City Clerk, until 8 p. m., Aug. 10, for the improvement of Main St., the work including 2,100 cu. yds. earth excavation, 1,775 sq. yds, cobblestone gutters, 4,428 sq. yds. macadam paving, furnishing and placing 6,000 ft. B. M. temporary hemlock curbing.

St. Paul, Minn.—Bids are asked by Board Public Works, R. L. Gorman, Clerk, until 2 p. m., Aug. 8, for the curbing (using cement curb), leveling, filling and sodding Capitol Ave., from Hamline Ave. to Aldine St.

St. Paul, Minn.—Bids are asked by Board Public Works, R. L. Gorman, Clerk, until 2 p. m. Aug. 5, for grading alley in Block 4, and for grading portion of Farrington Ave.

Marshfield, Mo.—Bids are asked by W. P. McKnight, City Clerk, until Aug. 30, for constructing about 98,000 ft. of macadamized street and 7,200 ft. of stone guttering.

Omaha, Neb.—Bids are asked by Dan B. Butler, City Clerk, until 8 p. m., Aug. 6, for curbing and paving a number of streets.

Concord, N. H.—Bids are asked by A. W. State Engineer, Concord, until Aug. 8, for constructing trap rock highway. Estimated cost of road is $7,000.

Hookset, N. H.—Bids are asked by A. W. Dean, State Engineer, Concord, N. H., until Aug. 8, for constructing gravel highway in this town.

Elizabeth, N. J.—Bids are asked by N. K. Thompson, Street Commissioner, until 8 p. m., Aug. 15, for improvement of 7th St., the work including: 270 cu. yds. earth excavation, 3,500 cu. yds. earth fill, 1,670 lin. ft. new curb, 1,720 lin. ft. new 4-ft. flag, 24 lin. ft. curbed corners.

Hoboken, N. J.—Bids are asked by James H. Londrigan, City Clerk, until 8 p. m., Aug. 28, for repaving portions of Grand St., Jefferson St., and Third St., with Belgian blocks

Riverton, N. J.—Bids are asked by Edward H. Pancoast, Chairman Highway Committee, until 8 p. m., Aug. 8, for furnishing material and constructing about 30,000 sq. ft. of cement paving, and for grading and graveling, or sodding about 8000 sq. yds. of sidewalk, according to plans and specifications on file at the office of the Borough Engineer, Henry S. Haines, 306 Temple Bldg., Camden, N. J., or at the office of the Borough Clerk.

Rosselle Park (P. O. Elizabeth), N. J.—Bids are asked by Mayor and Council, until 8 p. m., Aug. 2, for laying about 8,000 lin. ft. of 4-ft. stone flag sidewalk. J. Wallace Higgins, Borough Engineer.

Somers Point, N. J.—Bids are asked by James E. Scull, City Clerk, until 8 p. m., Aug. 5, for street work as follows: Macadam driveway, 11,928 sq. yds.; new blue stone curbing, 6,285 lin. ft.; resetting old curb, 1,365 lin. ft.; radius curb, 56 lin. ft. E. D. Rightmire, Engineer, Bartlett Bldg., Atlantic City, N. J.

Brooklyn, N. Y.—Bids are asked by Park Board, until 3 p. m., Aug. 8, for labor and material for constructing cement sidewalk and curb around parade ground, Prospect Park. Plans at office of Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn. Security required is $8,000.

Brooklyn, N. Y.—Bids are asked by Park Board, until 3 p. m., Aug. 8, for constructing asphalt tile walks in Winthrop, Cooper and Seaside Parks. Security required is $17,000. Plans at office of Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn.

Brooklyn, N. Y.—Bids are asked by Park Board, until 3 p. m., Aug. 15, for laying cement sidewalk around Rainey and Ashmend Parks, Queens Borough. Security required is $1,000. Plans at office of Department of Parks, Litchfield Mansion, Prespect Park, Brooklyn.

New York, N. Y.—Bids are asked by J. A. Bensel, Commissioner of Docks, Pier A, Battery Pl., until noon, Aug. 8, for furnishing all the labor and materials required for curbing and flagging and for laying granite pavement, with crosswalks, within the area of the marginal street on the Chelsea section, between W. 15th and W. 19th Sts., north river, Borough of Manhattan. Security required is $21,000.

New York, N. Y.—Bids are asked by J. A. Bersel, Commissioner of Docks, Pier A, Battery Pl., until noon, Aug. 6, for furnishing all the labor and materials required for preparing for and laying asphalt pavement at the approach to the Stapleton Ferry terminal at Staten Island. Security required is $800.

New York, N. Y.—Bids are asked by Henry S. Thompson, Commissioner of Public Works, Manhattan Borough, until 2 p. m., Aug. 6, for the work under six contracts for street improvement. Largest contract calls for relaying 5,000 sq. yds of old asphalt blocks and the construction of 20,000 sq. yds. asphalt block pavement. Next largest contract calls for regulating, grading, curbing, flagging and guttering Dyckman St., the work including 450 cu. yds. with excavation, 36,000 cu. yds. filling, 4,800 lin. ft. paved gutter, etc.

New York, N. Y.—Bids are asked by Louis F. Haffen, President Bronx Borough, 177th St. and 3rd Ave., until 11 a. m., Aug 6, for work under six contracts for street improvement. Largest contract calls for paving iron slag blocks on a concrete foundation the roadway of Clay Ave., from E. 166th st. to Wendover Ave., and setting curb where necessary, the engineer's estimate of the work being as follows: 18,330 sq. yds. of completed iron slag block pavement and keeping the same in repair for one year from date of acceptance; 2,700 cu. yds. of concrete, including mortar bed; 8,250 lin. ft. of old curb-stone rejointed, recut on top, and reset in concrete

Bellevue, Pa.—Bids are asked by J. M. Sinnerat, Borough Clerk, 60 Harrison Ave., until 6 p. m., Aug. 6, for grading Dewey Ave and Carolyn Ave Each bid must contain a certified check for $25 for each street C. E. Miller, Borough Engineer, 435 4th Ave., Pittsburgh, Pa.

Syracuse, N. Y.—Bids are asked by

Board of Contract and Supply, George J. Metz, City Clerk, until 1:30 p. m., Aug. 5, for the work under 8 contracts for constructing stone, cement, asphalt or brick sidewalks.

Akron, O.—Bids are asked by Board Public Service, C. H. Watters, Secretary, until noon, Aug. 6, for grading, curbing and paving portion of Good St.

Barnesville, O.—Bids are asked by F. Waldo Hilles, Village Clerk, until noon, Aug. 6, for grading and paving with brick Walton Ave. and Pash St.

Bellevue, O.—Bids are asked by Geo. Leiber, Village Clerk, until noon, Aug. 10, for paving with vitrified block, Castalia St. and Euclid Ave. Work includes 15,260 sq. yds. pavement on crushed stone foundation with necessary excavating, curbs, catch-basins and inlets. Certified check to the Village Clerk for $500 must accompany each bid. J. C. Overmyer, Fremont, O., is Engineer in Charge.

Cincinnati, O.—Bids are asked by Board Public Service, M. J. Keefe, Clerk, until noon, Aug. 12, for furnishing the labor and materials for the remodeling of the north end of 6th St., where it joins the east intersection of Gilbert Ave., by grading, paving with boulders, constructing Portland cement steps and wall and pipe railing.

Cleveland, O.—Bids are asked by A. R. Callow, Secretary of the Board of Public Service, No. 105 City Hall, until noon, Aug. 8, for grading, draining, curbing, paving and improving a number of streets. Portions of 34 streets are to be paved with brick, and bids are also to be taken on improving E. 115th St. with asphalt, Ford Rd. with tar macadam, and E. 75th St. and E. 53d St. with Medina stone.

Toledo, O.—Bids are asked by D. T. Davies, Jr., County Auditor, until 10 a. m., Aug. 7, for the repair of Stone Road No. 29 from the old side cut at Maumee to Waterville, Monclova and Waterville Townships.

Youngstown, O.—Bids are asked by North Newton, Secretary Commissioners of Road District No. 1, Room 215 Dollar Bank Bldg., Youngstown, until 11 a. m., Aug. 3, for material and labor for the improvement by turnpiking of the following roads: Belmont Ave. from the end of the pavement to the County Line, a distance of about 1½ miles, the Price Road from Mahoning Ave. viaduct to the west end of said road, about 1 mile. Edwin D. Haseltine, Engineer of Road District No. 1, 1818 Wilson Ave., Youngstown.

Youngstown, O.—Bids are asked by Board Public Service, W. H. McMillin, Clerk, until noon, Aug. 2, for grading Garlick St. from Waldo to Tremont St.

Sewers.

Items Arranged Alphabetically by States.

Arkadelphia, Ark.—Bids are asked by Commissioners of Sewer District No. 1, until noon, Aug. 15, for construction of 45,280 ft. of clay pipe sewers. Plans, etc., may be had of Theo. Hartman, Engineer in charge, 1122 Center St., Little Rock, Ark., or J. E. Callaway, Arkadelphia, Ark.

Lincoln, Cal.—Bids are asked by this town until Aug. 13, for construction of a sewer system to consist of 3,300 ft. 10-in. sewer, 5,500 ft. 8-in. sewer, 17,000 ft. 6-in. sewer and septic tank. Specifications may be obtained from the Town Clerk.

Oakland, Cal.—Bids are asked by Board Public Works, Walter B. Fawcett, Secretary, until 10 a. m., Aug. 14, for labor and materials for and in the construction of a concrete and ironstone pipe storm sewer in Canning St., from 63rd St. an Temescal Creek.

Denver, Colo.—Bids are asked by Moses Hallett, Room 31, Clayton Block, Denver, until 11 a. m., Aug. 7, for furnishing materials and labor and for constructing the Clayton college pipe line, comprising about four miles of vetrified clay pipe and steel pipe with manholes and other appurtenances, according to plans and specifications in office of Peter O'Brian, Civil Engineer, Nassau Block, Denver.

New Haven, Conn.—Bids are asked by C. W. Kelley, City Engineer, until 2 p. m., Aug. 1, for constructing sewers in Scranton St., from Day St. to Waverly St.; Hobart St., from Whalley Ave. to Elm St.; Livingston St., from Cold Spring St. to E. Rock Road; Howard Ave., from Sea St. to near So. Water St.; Dixwell Ave., from Ivy St. to Willis St., and Willis St., from Dixwell Ave. to city line.

Boise, Idaho.—Bids are asked by Capt. Jno. S. Winn, Constructing Q. M., until 11 a. m., Aug. 14, for construction of drainage system and for grading at Boise Barracks, Idaho.

Chicago, Ill.—Bids are asked by Board Local Improvements, Ora E. Chapin, Secretary, City Hall, until 10:15 a. m., Aug. 7, for work under 15 contracts for constructing tile pipe sewers and work under one contract for constructing system of brick and pipe sewers in N. 56th Ave. Bids are also asked for work under 20 contracts for constructing drains.

Collinsville, Ill.—Bids are asked by Board Local Improvements, J. L. R. Wadsworth, President, until 2 p. m., Aug. 20 for constructing sanitary septic sewer system known as District No. 1.

North Chicago, Ill.—Bids are asked by W. H. Brownson, Chief Bureau of Navigation, Navy Department, Washington, D. C., until noon, Aug. 21, for laying sewers and drains at Naval Training Station, Great Lakes, North Chicago. Plans, etc., with Commandant Naval Training.

River Forest, Ill.—Bids are asked by Board Local Improvements, Ralph Scarritt, Vilage Clerk, until 8 p. m., Aug. 5, for constructing sewer in Chicago Ave. Estimated cost of work is $17,086.

Burlington, Ia.—Bids are asked by City Clerk, until 4 p. m., Aug. 5, for constructing vitrified pipe sewer in first alley east of Foster St. Certified check for $400 required with bid. J. F. Winters is City Engineer.

Columbus, Ind.—Bids are asked by the City Council until 8 p. m., Aug. 5, for the construction of a large sewer in Fifth and Mechanic Sts. L. F. Orr is City Clerk.

Davenport, Ia.—Bids are asked by Board Public Works, Thomas Murray, City Engineer, until 2 p. m., Aug. 6, for constructing 3,410 lin. ft., 12-in. sewer in Park Lane, and 1,180 lin. ft. of 12-in. sewer in 9th St.

Grinnell, Ia.—Bids are asked by Willis Davis, City Clerk, until 7 p. m., Aug. 6, for labor and material for construction of sanitary sewer and extension to the water system, the work consisting of about 18,400 ft. of sewer, to be made of vitrified sewer tile and cement and 30 ft. of iron sewer pipe, and 18,400 ft. of water main, to be made of iron water pipe and galvanized iron pipe.

Westfield, Mass.—Bids are asked by Board of Selectmen, until noon, Aug. 3, for constructing about 3,250 ft. of 8-in. to 18-in. pipe sewer. Oren E. Parks, Town Engineer.

St. Paul, Minn.—Bids are asked by Board Public Works, R. L. Gorman, Clerk, until 2 p. m., Aug. 5, for construction of a sewer in Portland Ave.

St. Paul, Minn.—Bids are asked by Board Public Works, R. L. Gorman, Clerk, until 2 p. m., Aug. 8, for constructing sewers in portions of University Ave. and Jessamine St.

Sedalia, Mo.—Bids are asked by C. E. Baker, City Clerk, until 5 p. m., Aug. 5, for constructing sewer in Sewer District No. 36.

Helena, Mont.—Bids are asked by Martin Doty, City Clerk, until noon, Aug. 5, for the construction and grading of the Le Grand Cannon boulevard, from the city limits to the south side of Mauldin St.

St. Joseph, Mo.—Bids are asked by Board Public Works, George F. Barnes, Clerk, until 11 a. m., Aug. 1, for labor and material for constructing following sewers: Extension of South St. Joseph main sewer on Missouri Ave., 350 lin. ft., 3-ft. circular brick, concrete, vitrified pipe or reinforced concrete sewer; Wyatt Park extension main sewer, 946 lin. ft. 3½-ft. sewer; extension of main sewer in King Hill Ave., 672 ft. 33-in., 640 lin. ft. 30-in. and 320 lin. ft. 24-in. sewer.

Cope Girardeau, Mo.—Bids are asked by this city until Aug. 19, for construction of sanitary sewer system in Sewer District No. 1, comprising about 12 miles of pipe varying from 8-in. to 24-in. C. C. Hawley, City Engineer.

Helena, Mont.—Bids are asked by Martin Doty, City Clerk, until noon, Aug. 5, for constructing sewers in Special Improvement Districts Nos. 22 and 23. Certified check for $500 for each district required with bid.

Omaha, Neb.—Bids are asked by the City Engineer, until 2 p. m., Aug. 5, for construction of following sewers: In Sewer District No. 337., an 8-in. pipe sewer; in District No. 338, an 18-in. pipe sewer; a 15-in. sewer and an 8-in. sewer, in District No. 339, an 8-in. pipe sewer, and in District No. 340 an 8-in. pipe sewer. Dan B. Butler, City Clerk.

Elizabeth, N. J.—Bids are asked by N. K. Thompson, Street Commissioner, until 8 p. m., Aug. 15, for the following work to be done and material furnished: 200 lin. ft. 10-in. pipe sewer, 2 manholes, 11 10-ft.x6-in. connections, 176 lin. ft. 6-in. pipe to curb, 11 1-8 turn.

Westfield, N. J.—Bids are asked by Lloyd Thompson, Town Clerk, until 8:30 p. m., Aug. 5, for material and labor necessary to construct an outlet sewer from the sewage disposal works of Westfield, to a point where Madison Hill Road crosses Robinson's Branch of the Rahway River —a distance of about 2½ miles. Plans, etc., with Town Clerk.

Amsterdam, N. Y.—Bids are asked by Sewer Commissioners, A. T. Young, Secretary, until Aug. 2, for constructing a number of sewers.

New York, N. Y.—Bids are asked by Henry S. Thompson, Commissioner of Public Works, Manhattan Borough, until 2 p. m., Aug. 6, for the work under six contracts for constructing sewers. Largest contract calls for construction of sewer in Sherman Ave. and other streets, the work including: 938 lin. ft. brick sewer of 3 ft. 6 in. by 2 ft. 4 in. interior diameter, Class I; 402 lin. ft. of brick sewer of 3 ft. 6 in. by 2 ft. 4 in. interior diameter, Class II; 1,760 lin. ft. of salt-glazed vitrified stoneware pipe sewer of 15 ins. interior diameter; 135 lin. ft.. of salt-glazed vitrified stoneware pipe culvert of 12 ins. interior diameter; 6 receiving basins of the circular pattern, with new style grate bars, and bluestone heads; 570 cu. yds, of rock, to be excavated and removed; 1,000 ft. (B. M.) of timber and planking for bracing and sheet piling, 5,280 ft. (B. M.) of timber and planking for foundation.

New York, N. Y.—Bids are asked by Louis F. Haffen, President Bronx Borough, 177th St. and 3rd Ave., until 11 a. m., Aug. 6, for the work under four contracts for sewer construction. Largest contract calls for rebuilding a second addition portion of the sewer in E. 149th St., near the New York, New Haven & Hartford Railroad crossing, the engineer's estimate of the work being as follows: 5,000 cu. yds. of excavation, 240 cu. yds. of concrete, 14,500 lbs. of steel bars, ½-in., ⅝in., ⅞in.; 1,410 lbs. of steel in 20-in. "I" beams, 560 sq. ft. of expanded metal, 35 sq. ft. of wire netting, 1 manhole, complete; 10 spurs, including surrounding concrete; 22,500 ft. B. M. timber, 2,900 lin. ft. of piles, 50 cu. yds. of broken stone for foundations, 120 lin. ft. of 6-in. pipe, as risers for house connections, including surrounding concrete, shown on plan.

Akron, O.—Bids are asked by Board Public Service, C. H. Walters, Secretary, until noon, Aug. 6, for the following work: Construction of a local sewer in a portion of Augusta Ave., construction of a main trunk sewer and filter bed appurtenant thereto, along a course from the intersection of Bailey Ave. with Portage Path to a point in the Summit County Infirmary Farm and in a portion of Exchange St.

Delaware, Ill.—Bids will be received at office of Superintendent of Girls' Industrial Home, Delaware, until 6 p. m., Aug. 23, for constructing sewage disposal plant and connections thereto. The work will include: 2,657 cu. yds. earth excavation; 284 cu. yds. rock excavation; 6 cu. yds. brick masonry; 229 cu. yds. concrete masonry; 4,764 lbs. steel; 5,040 ft. sewer pipe, 3, 6, 8, 10 and 12-in.; 612 ft. cast iron pipe, 2 and 4-in.; 3,004 lbs. cast iron specials; 14 cu. yds. coke; 1,378 cu. yds. crushed stone; 1,630 cu. yds. lake sand; 4,000 sq. ft. plastering rock surfaces; 470 sq. yds. sodding. E. G. Bradbury and G. P. Shute, Engineers, 85 N. High St., Columbus, O.

Elyria, O.—Bids are asked by Board Public Service, Rose Moriarty, Clerk, until noon, Aug. 2, for constructing sanitary sewer in E. 4th St. Certified check for $500 required with bid.

Lima, O.—Bids are asked by Board Public Service, L. L. Crumrine, Secretary, until noon, Aug. 2, for construction of a trunk sewer 15-in. to 30-in., of brick, tile or concrete. Certified check for $300 required with bid.

Chester, Pa.—Bids are asked by Samuel McClure, Chairman Sewer Committee, until 8 p. m., Aug. 5, for construction of following sewers: 18-in. terra cotta sewer in Market St. and 8th St., 3-ft. brick and 18-in. terra cotta sewer in 4th St., 18-in. terra cotta sewer in Morton, and an 18-in. terra cotta sewer in Barclay St. Specifications with City Engineer.

Taylor Pa.—Bids are asked by Edward Sweet, Borough Clerk, until 6 p. m., Aug. 6, for constructing lateral sewer in Second Sewer District. Certified check for $200 required with bid. Plans, etc., with A. B. Dunning, Jr., Borough Engineer, 803 Mears Bldg., Scranton, Pa.

Madison, S. Dak.—Bids are asked by Regents of Education, Spearfish, S. Dak., until 9 a. m., Aug. 12, for construction of sewer system for Madison Normal School, according to plans and specifications on file at the office of the Secretary of the Madison Normal School.

Siaux Falls, S. Dak.—Bids are asked by Lewis Larson, City Auditor, until 8 p. m., Aug. 5, for the construction of a main intercepting sewer, 40 ins. in diameter—in Phillips Ave. Alternative bids will be received for the construction of said sewer with stone blocks, plain concrete and reinforced concrete pipe.

Green Bay, Wis.—Bids are asked by this City until Aug. 8, for constructing 9,000 ft. brick or concrete sewer and 10,000 ft. vitrified pipe sewer. W. W. Reed, City Engineer.

Sparta, Wis.—Bids are asked by Council Sewer Committee, until 2 p. m., Aug. 5, for constructing sewers as follows: 582 ft. 6-in. sewer in Chester St., 551 ft. 6-in. sewer in Benton St., 831 ft. of 8-in. and 10-in. sewer; also for construction of storm sewer consisting of 519 ft. 18-in., 608 ft. 24-in., 149 ft. 12-in., and 153 ft. 12-in. sewer. J. T. Hutson is Chairman Street Committee.

Waukesha, Wis.—Bids are asked by Board Public Works, until 2 p. m., Aug. 5, for labor and material for constructing 2,120 ft. of sewer on Main St., and 395 ft. of sewer on Charles St.

Water Supply

Items Arranged Alphabetically by States.

Newark, Del.—Bids are asked by W. R. Kennedy, until Aug. 3, for installation of about 6,000 ft. 4-in. water main for this town.

Chicago, Ill.—Bids are asked by Board Local Improvements, Ora E. Chapin, Secretary, City Hall, until 10:15 a. m., for work under five contracts for constructing water supply pipe, and work under 21 contracts for constructing water service pipes.

Lombard, Ill.—Bids are asked by H. L. Whitely, Clerk, until 7:30 p. m., Aug. 19, for furnishing and erecting 60,000-gallon capacity steel tank upon a steel tower. W. S. Shields, Engineer, 1201 Hartford Bldg., Chicago, Ill.

Grinnell, Ia.—See under Bids Asked—Sewers.

Chesterton, Ind.—Bids are asked by Home Water Co., until Aug. 3 (change of date) for the complete construction of a system of waterworks. Plans and specifications can be seen at the Chesterton Bank.

Springfield, Mass.—Bids are asked by Board of Water Commissioners, E. E. Stone, Chairman, until 2 p. m., Aug. 21, for the construction of the work included under Contract No. 1, Intake Dam and Tunnel, Little River Water Supply. The work comprises the driving and lining of a tunnel about 4,530 ft. long, the construction of a masonry dam containing about 9,500 cu. yds. of cyclopean masonry, together with gate house, and all necessary appurtenances. Plans, etc., at the office of E. E. Lochridge, Chief Engineer, Springfield, Mass., and at the office of Hazen & Whipple, Consulting Engineers, 220 Broadway, New York City.

Kenyon, Minn.—Bids are asked by the Village Recorder, until Aug. 5, for improvements to water works system.

Philadelphia, Pa.—Bids are asked by Director of Public Works, until noon, Aug. 22, for Contract No. 102—Preliminary Filters at Torresdale; Contract No. 108—Roxborough Pipe Extension System. Specifications, drawings and blank forms upon which bids must be made can be obtained from the Chief Engineer of the Bureau of Filtration, Room 712, City Hall, to whom all communications should be addressed.

Fort Hancock, N. J.—Bids are asked by Capt. M. N. Falls, Q. M., until 2 p. m., Aug. 21, for furnishing and placing a "Cook" strainer in deep well at Fort Hancock.

New York, N. Y.—Bids are asked by Park Board, until 2 p. m., Aug. 8, for furnishing all the labor and materials necessary to construct and complete a pumping plant in Forest Park, Borough of Queens, together with all the work incidental thereto. Security required is $6,000. Blank forms may be obtained and plans may be seen at the office of the Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn.

Cincinnati, O.—Bids are asked by Board of Trustees, "Commissioners of Water Works," Elmer G. Prior, Clerk, until noon, Aug. 27, for laying about 2,600 lin. ft. of 8-in. and 12-in. cast iron water mains.

Bonesteel, S. Dak.—Bids are asked by M. P. Dowling, Town Clerk, until Aug. 8, for the construction of a complete system of water-works for this town.

Excavation—Earth and Rock

Items Arranged Alphabetically by States.

Arkansas City, Ark.—Drainage Ditches.—Bids are asked by W. B. Meeks, Clerk County Court, until Aug. 5, for construction of drains in Drainage District No. 1, the work including removal of about 600,000 cu. yds. of material. Plans, etc., with Mr. Meeks.

New London, Conn.—Dredging.—Bids are asked by Major Harry Taylor, U. S. Engrs., until noon, Aug. 19, for dredging at mouth of Connecticut River, Conn.

Savannah, Ga.—Dredging. — Bids are asked by Lt.-Col. Dan C. Kingman, U. S. Engrs., until noon, Aug. 23, for dredging Skidaway Narrows, Ga.

Mason City, Ia.—Tile Drains.—Bids are asked by A. S. Clark, County Auditor, until 1 p. m., Aug. 7, for construction of County Drain No. 7, involving laying of 11,590 ft. of tile drains in Secs. 15, 16 and 22, Dougherty Township.

Sibley, Ia.—Ditch Work.—Bids are asked by V. A. Burley, County Auditor, until noon, Sept. 10, for the construction of about 8 miles of open ditch, involving 103,000 cu. yds. excavation.

New Orleans, La.—Levee Work.—Bids are asked by Board of Commissioners, Orleans Levee District, T. J. Duggan, Secretary, Masonic Temple, New Orleans, until Aug. 2, for following levee work; Dublin to Fern St., new levee and revetment, containing about 90,000 cu. yds. of earthwork and 77,000 ft. building material of creosoted pine lumber in revetment. 7th St. to 3d St., new levee containing about 100,000 cu. yds. of earthwork.

Fort Washington, Md.—Grading, Draining.—Bids are asked by Constructing Q. M., U. S. A., Fort Washington, until noon, Aug. 26, for draining and grading drill grounds at that post.

Aztec, N. Mex.—Irrigation Canal.—Bids are asked by Citizens' Ditch & Irrigating Co., Aztec, N. Mex., until Aug. 10, for the construction of an irrigating canal 20 miles long, located in San Juan County, New Mexico. Certified check for $5,000 must accompany each bid.

New York, N. Y.—Embankment.—Bids are asked by Lt.-Col. W. L. Marshall, U. S. Engrs., until noon, Aug. 26, for furnishing material and building embankment at Governors Island, New York Harbor.

Miscellaneous

Items Arranged Alphabetically by States.

Oakland, Cal.—Street Sweeping.—Bids are asked by Board Public Works, Walter B. Fawcett, Secretary, until 10 a. m., Aug. 14, for sweeping and cleaning by machinery during the fiscal year ending June 30, 1908, such public streets of the city of Oakland as are or may be paved with bituminous rock, asphalt or wood blocks.

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Santa Barbara, Cal.—Bulkhead.—Bids are asked by Alfred Davis, City Clerk, until 10 a. m., Aug. 10, for the construction of a bulkhead on the East Boulevard, Santa Barbara. Plans, etc., on file in the office of the City Engineer. Certified check for $3,500 must accompany each bid.

Key West, Fla.—Breakwater.—Bids are asked by James Knox Taylor, supervising architect, Washington, D. C., until 3 p. m. Aug. 14, for the construction of a new breakwater wall at the U. S. Marine Hospital, Key West, Fla.

Boston, Mass.—Subway Entrance.—Bids are asked by Boston Transit Commission, 15 Beacon St., until noon, Aug. 15, for constructing entrance and exit at corner of Water and Devonshire Sts., for the Washington St. Tunnel.

Hadley, Mass.—Riprap. Bids are asked by Harbor and Land Commissioners, Room 131, State House, Boston, Mass., until 2 p. m., Aug. 9, for furnishing and placing riprap on the southeasterly bank of the Connecticut River in Hadley. The work to be done is the furnishing and placing of about 4,500 tons of stone as riprap on the southeasterly bank of the Connecticut River at and near the northerly ends of West and Middle Sts., in the town of Hadley.

Webb City, Mo.—Railroad.—Bids are asked by F. M. Overlees, President, St. Louis, Bartlesville & Pacific R. R., Bartlesville, Ind. Ter., until Sept. 1, for building and equipping that road to extend from Webb City, Mo., to Pond Creek, Okla. Ter. Further detailed information, with plans, specifications, etc., can be had at the company's office.

Brooklyn, N. Y.—Crib Bulkhead.—Bids are asked by Bird S. Coler, President Brooklyn Borough, until 11 a. m., Aug. 7, for furnishing all labor and material required for preparing for and building a crib bulkhead on the Eighth Ward Market, between 36th and 38th Sts., 2nd Ave. and New York Bay, Borough of Brooklyn, the City of New York. Total estimated cost of work is $156,934 and it includes 06,200 cu. yds. dredging, 3,800 cu. yds. dredging, (old crib and canal boats, measured in place), 258 old piles, to be removed, 1,103,850 cu. ft. crib bulkhead, (round log crib bulkhead, complete), 30,070 cu. ft. crib bulkhead, (round log crib bulkhead, with square timber face), 2,710 cu. yds. concrete face wall, etc.

New York, N. Y.—Tunnel—Bids are asked by Myles Tierney, President Board Trustees, 26th St. and 1st Ave., until 3 p. m., Aug. 12, for all the labor and materials required for a tunnel connecting the training school for women nurses with pavilions A and B of the new Bellevue Hospital, situated under 26th St., east of 1st Ave., Borough of Manhattan, the City of New York. The surety required will be $6,000.

New York, N. Y.—Pier.—Bids are asked by J. A. Bensel, Commissioner of Docks, Pier A, Battery Pl., until noon, Aug. 6, for furnishing all the labor and materials required for preparing for and building a new pier at the foot of James Slip, and for preparing for and building a new bulkhead platform easterly from said pier, between James Slip and Oliver St., east river. Security required is $14,500.

New York, N. Y.—Freight Sheds.—Bids are asked by J. A. Bensel, Commissioner of Docks, Pier A, Battery Pl., until noon, Aug. 13, for furnishing all the labor and materials required for preparing for and building freight sheds on Piers 57, 58 and 59, between W. 14th and W. 19th Sts., north river, with lateral extensions on the adjacent bulkhead platforms. Security required is $402,000.

Hickory, N. C.—Dam, Power Plant, Etc.—Bids are asked by M. E. Thornton, President Water Power Electric Co., Hickory, until Aug. 10, for construction of concrete rock-reinforced dam across Catawbo River, also for installation of 3,000-horse-power turbine wheels and electrical apparatus and transmission lines for power and lighting; three-phase, alternating current, 60-cycle, or better. C. S. Wenger, Engineer in Charge, Brownstown, Pa.

Cleveland, O.—Power House Superstructure.—Bids are asked by A. R. Callow, Secretary of the Board of Public Service, No. 105 City Hall, until noon, Aug. 8, for the completion of the superstructure of the power house for the municipal electric light plant.

STORM WATER SEWERS.

Omaha, Neb., July 29, 1907.

Sealed proposals will be received at the office of the City Engineer up to 2 o'clock p. m., Monday, August 26th, for the construction of storm water sewers and appurtenances as per plans and specifications on file in the office of the City Engineer.

The work to be done embraces approximately as follows:

840 feet sewer, 10 feet in diameter.

860 feet sewer, 11 feet 3 inches in diameter.

1,140 feet sewer, 12 feet in diameter.

250 feet, more or less, of 16 by 7½ reinforced concrete construction.

80 feet sewer 42 inches in diameter.

1,600 feet sewer, 30 inches in diameter.

150 feet open ditch work.

Payment for said work to be made upon a cash basis; 90 per cent on monthly estimates; an additional 5 per cent when work is accepted, and 5 per cent in one year after the completion of the work. Each bid shall be accompanied with a certified check in the sum of $3,000.00 as guarantee of good faith that the bidder will promptly enter into contract if award shall be made to him. The city reserves the right to reject any or all bids.

ANDREW ROSEWATER,
5-4t City Engineer.

SEWER CONSTRUCTION.

Gas City, Ind.

Sealed proposals will be received until 8 o'clock p. m. of August 13, 1907, by the City Clerk of Gas City, Ind., for the construction of a sanitary and storm sewer system in different streets and alleys. Total length about three and one-tenth miles. Approximate cost $24,000. C. E. Petrie, Engineer, City Building, Marion, Ind. Plans and specifications on file at my office.

GEORGE S. MARSHALL,
5-1t City Clerk.

BRICK PAVING.

Monessen, Pa.

Notice is hereby given, by order of the Streets and Roads Committee of the Borough of Monessen, Pennsylvania, sealed proposals will be received at the office of the Borough Engineer until 6:00 P. M., August 9th, 1907, for the grading, curbing and paving of approximately, 17,500 square yards of paving with vitrified block. Plans and specifications are on file in the office of the Borough Engineer.

Each bid must be accompanied by a certified check for $500.00, which will be returned to the successful bidder on execution of the contract; or forfeited if he should fail to enter into and execute the contract awarded him, in which case, Council may accept any other bid.

All other checks will be retained until the contract is signed, when they will be returned. The right is reserved to reject any or all bids.

W. A. MILLER,
Chairman St. & Roads Com
J. F. IRWIN,
4-3t Borough Engineer

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No. 2 Smith Mixer, engine and boiler on wheels	675.00
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Bucyrus 70 ton shovel (new)	9,900.00
New 10 ton American Tandem roller	1,700.00
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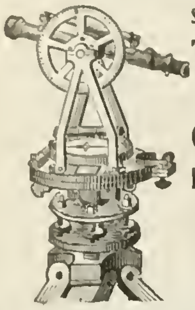

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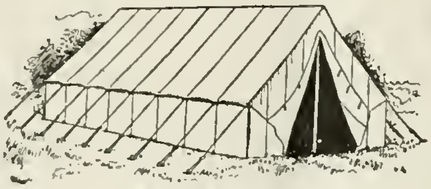

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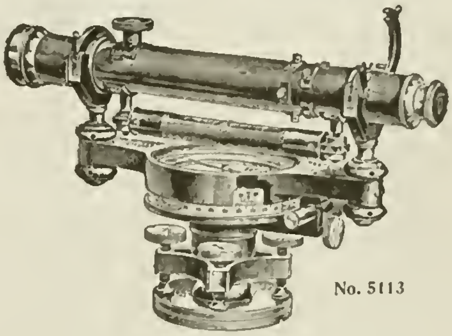

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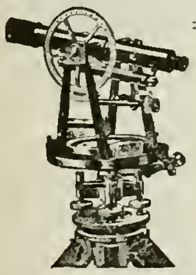

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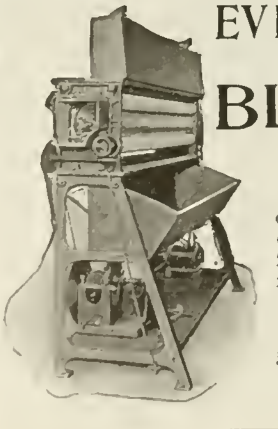

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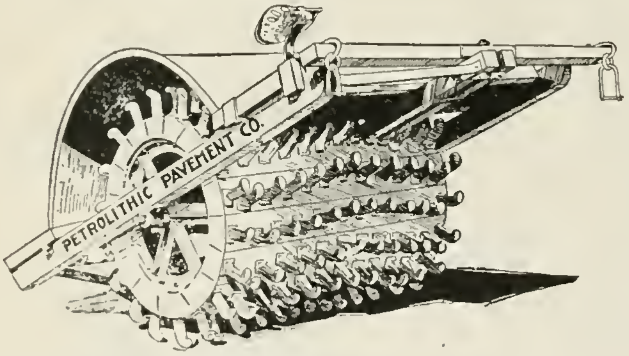
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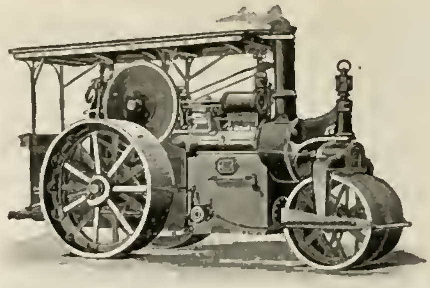

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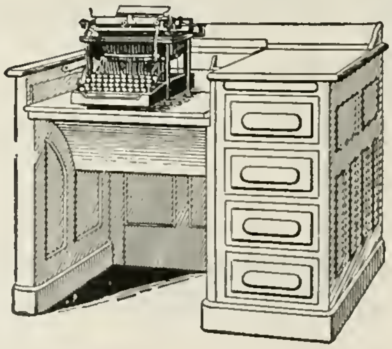

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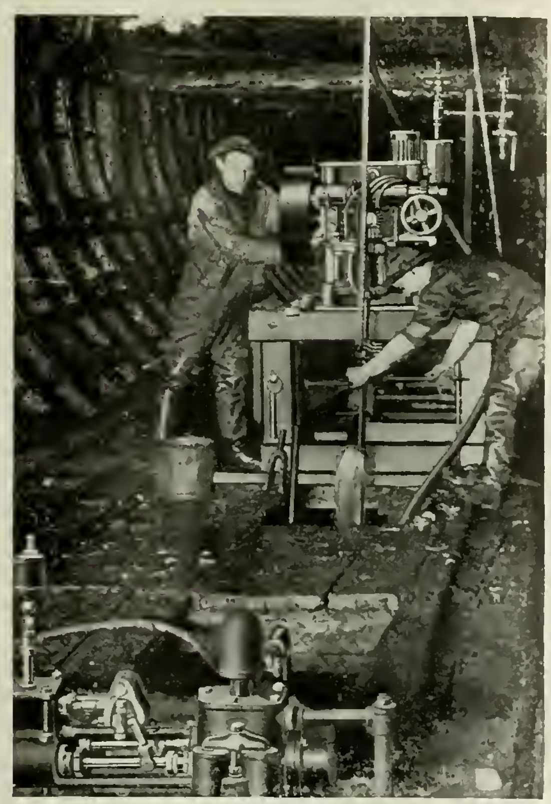

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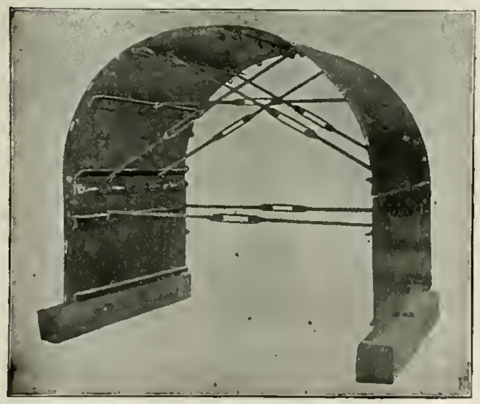

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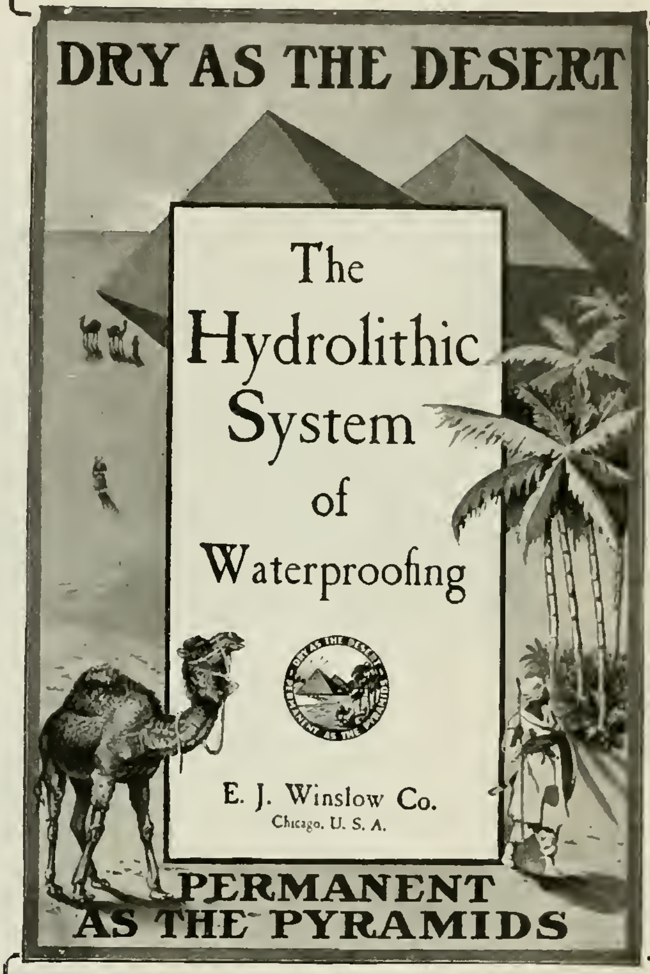
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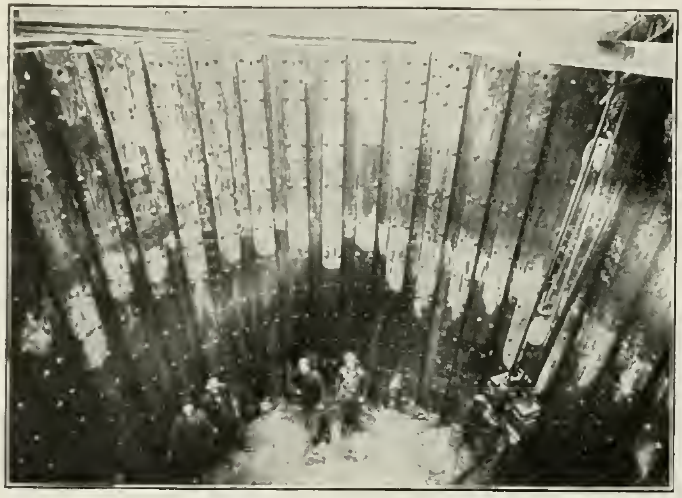

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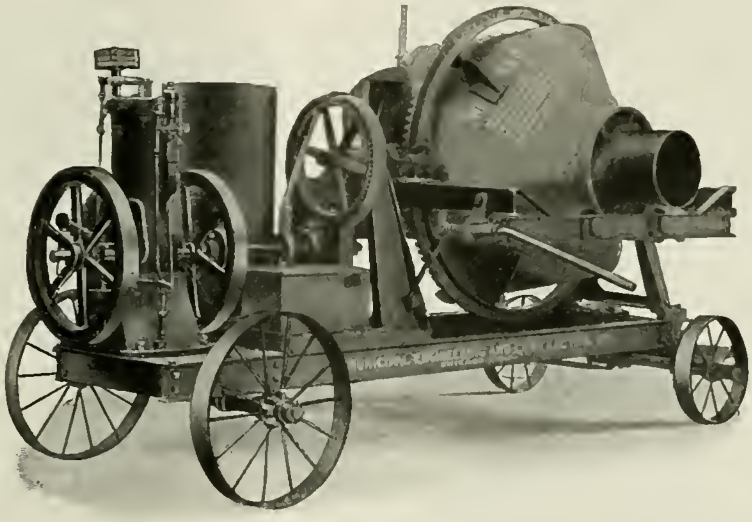

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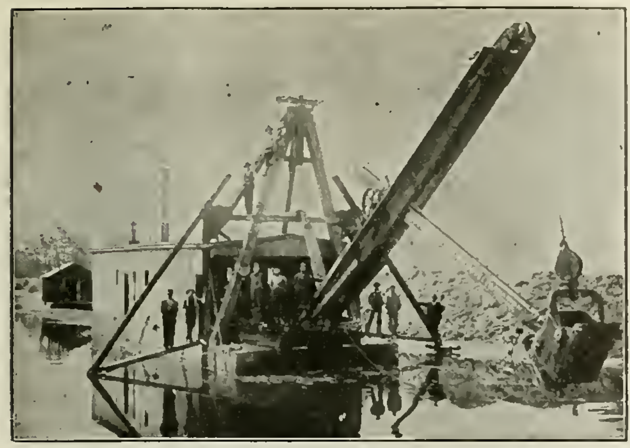

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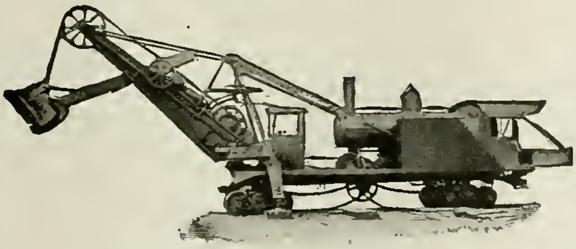

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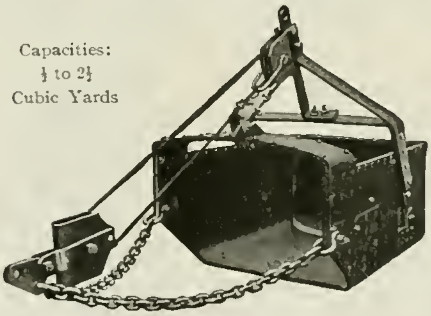

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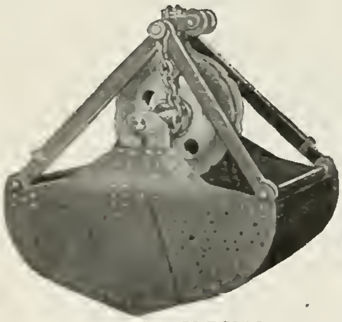

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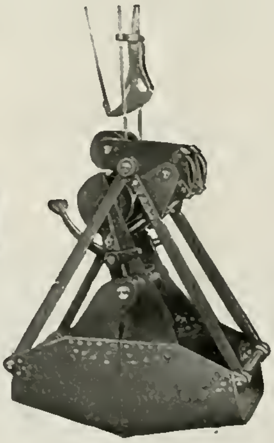

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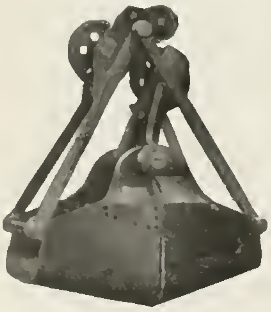

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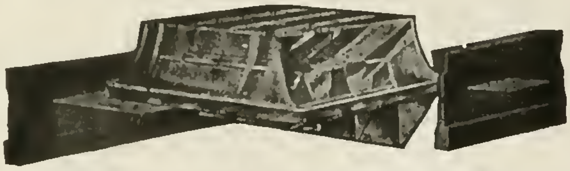

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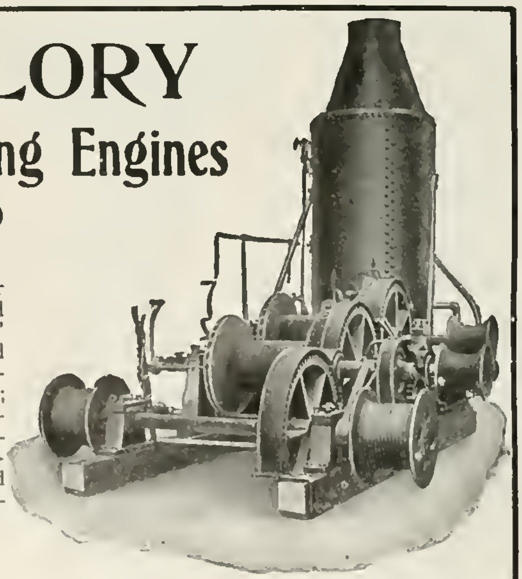

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Early last year, Halbert P. Gillette, Managing Editor of this journal, issued a call to contractors and engineers, asking them to join in forming an American Society of Engineering Contractors. Mr. Gillette agreed to act as chairman and secretary of the Society, *pro tem*, and in that capacity has received several hundred applications for charter membership. The experimental stage is past, and a large membership of influential men is now assured. We urge every contractor and every engineer to join this great national organization. One of the main objects of the society is to secure uniform and equitable general clauses in engineering specifications. Another object is to combat the inefficient "day-labor system" of doing public work, and to educate the public to the true economy of doing all work by contract. A third object is to have a voice in the solving of all social problems affecting the welfare of contractors and engineers, such as the problems raised by labor unions. A fourth object is to exchange ideas on the management of men, the operation of machinery, the keeping of cost records, and such other business as would naturally come before a national organization of this character. If you have not already applied for membership, do so on the accompanying blank; and then urge your friends to join.

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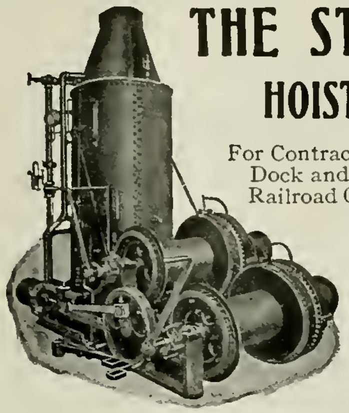

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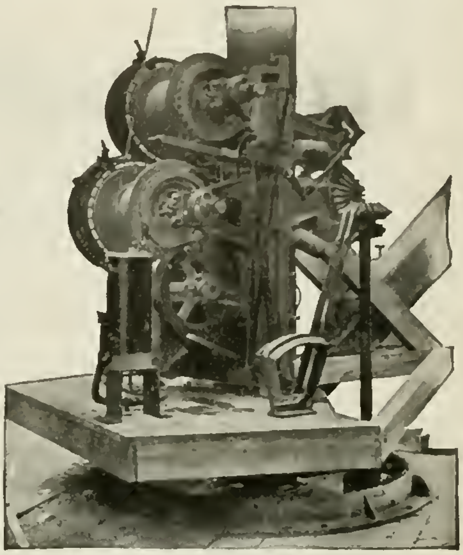

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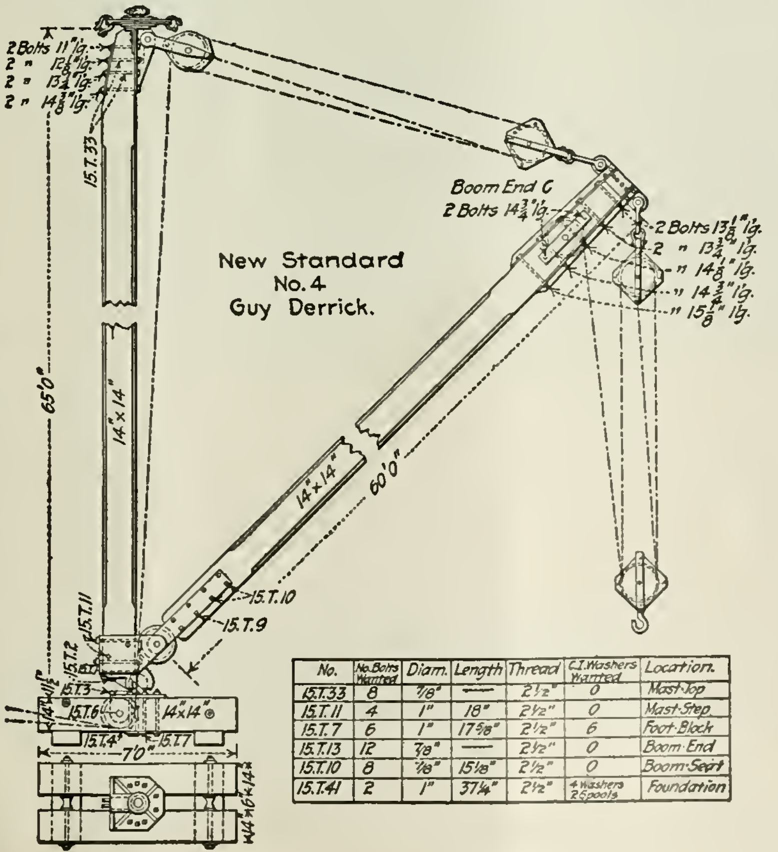

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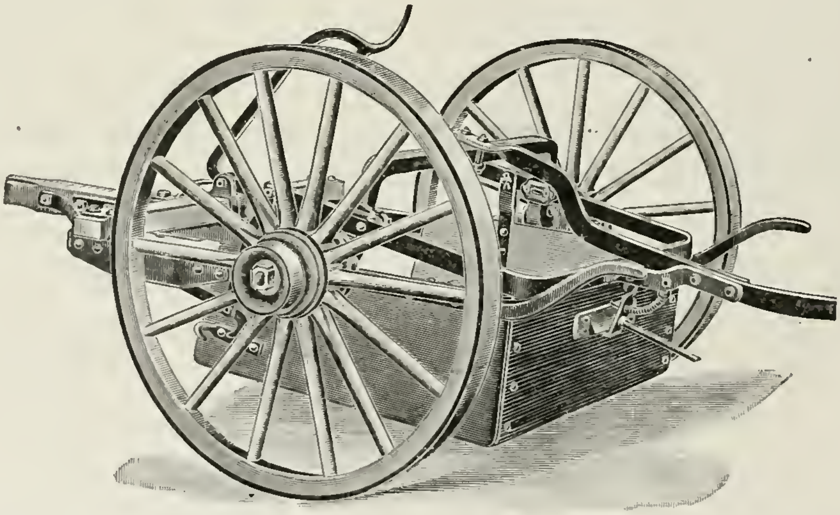

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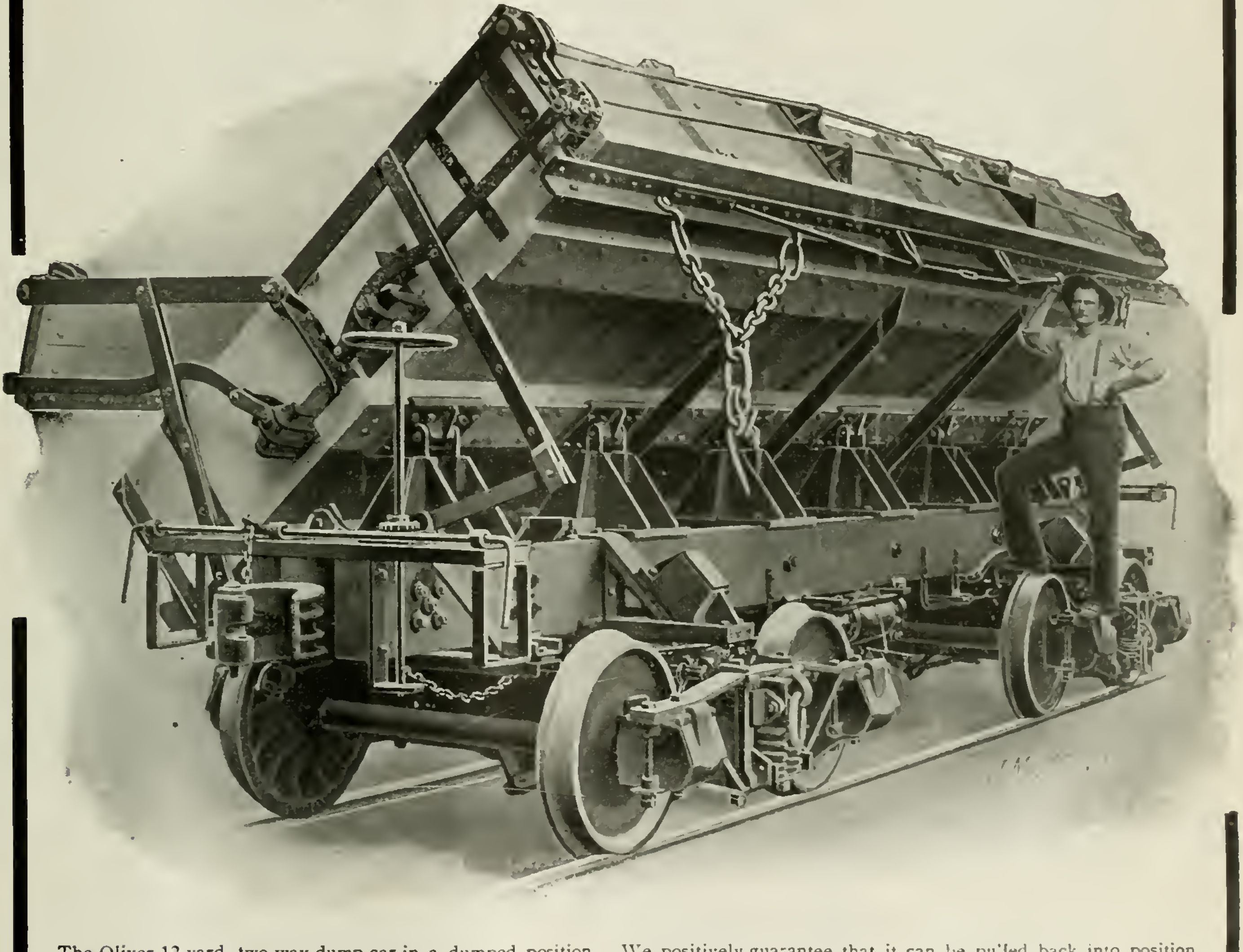

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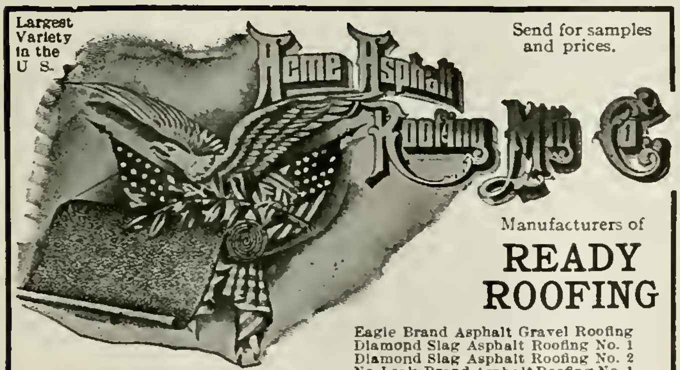
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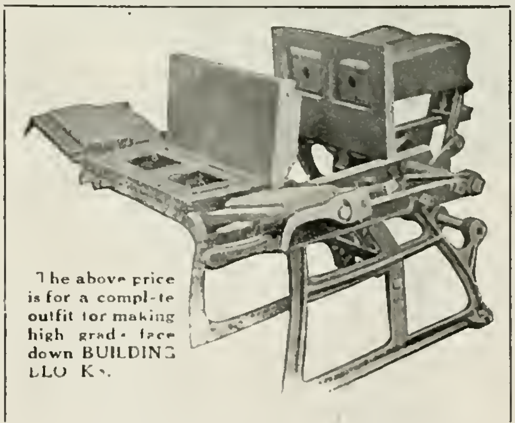

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Underpinning Soft Ground Tunnels.

Some three years ago when the plans for the Pennsylvania R. R. tunnels under the Hudson river at New York city were made public, engineers were astonished to observe that the designers of the work had planned to support the tubes on piers sunk through the invert lining to firm soil beneath the unstable bed of silt. There were many, doubtless, who questioned the possibility of accomplishing the task laid down by the engineers, while all have waited with interest the time when a practical trial of pier construction should demonstrate its success or failure. Meanwhile the possibility of the plan has been proven in another place and on another work. The construction of the East River tunnel of the New York Rapid Transit Railway developed such faults in alignment and level that reconstruction in part became necessary, and popular apprehension was aroused as to the safety of the tunnel structure. To allay this feeling of insecurity it was decided to underpin the tunnel tubes as well as to correct the faults in level. The progress of this work is described in another column. While the work of underpinning has not been completed, enough of it has been completed to establish the feasibility and safety of the task. There are some differences between the North River silt and the East River sand strata, but they do not seem great enough to rank the North River underpinning work as greatly more dangerous or difficult. It must be remembered that the underpinning of the North River tunnels possesses the advantage of being planned ahead. The inverts of the North River tubes are provided with segments, so designed that the pier shells can be passed through a perfectly sealed opening; in the East River work described in this issue, a considerable portion of the invert lining had to be renewed, leaving no support for the material laid bare but the air pressure under which the work was done. Altogether the successful experience in underpinning the Rapid Transit tunnels should go far toward establishing this as a feasible and useful type of tunnel construction.

Philadelphia Filtration Frauds Arbitrated.

Few of our readers will fail to recall the fine frenzy into which the usually staid citizens of Philadelphia worked themselves a couple of years ago over "discovered" frauds in the construction of the city's $18,000,000 filtration system. For a few months charges of excessive cost, inferior construction, collusion and fraud were freely made against city officials and contractors. A popular uprising was instigated, the "rats were cleared from the city hall," and a reform administration was inaugurated with cheers and effigies burned in the market place. Then the people set to work to punish the offenders. The former chief of the filtration bureau, an engineer without a previous black mark against his honesty or ability, was haled before the courts and an unsuccessful attempt made to prove his connivance with fraud. When it came the contractors' turn to stand for judgment it was decided for some reason not to invoke the law, but to appoint an arbitrator to determine the contractors' culpability. This arbitrator, an ex-judge of the state supreme court, rendered his decision on July 22. The decision is too voluminous to be quoted here, but in general the arbitrator holds that there is no evidence of fraud, conspiracy or dereliction of duty on the part of the contractors or any ex-city official in connection with the award or execution of the contracts with the exception that a certain contract awarded the McNichol firm while Mr. McNichol was a member of the city council was illegal. The profits on this contract, amounting to $51,300, are forfeited to the city. Deferred payments to the McNichol interests, amounting to some $2,000,000, are ordered paid by the referee. With this decision the incident of the Philadelphia filtration scandals becomes a matter of history. Altogether it is an incident which inspires anything but pride in the municipal dealings of the Quaker City—if guilty, as charged by the people, the parties concerned have been very inadequately punished, if innocent, as the arbitrator has decided, they have been unjustly punished.

Cost of Drilling and Blasting Soft Shale Rock Under Water, Using Drill Boats at Ashtabula Harbor, Ohio.

The following costs of drilling and blasting shale rock under water at Ashtabula Harbor, Ohio, have been furnished by Mr. E. C. Brown, Jr., Assistant Engineer, Lake Shore & Michigan Southern railway. The work recorded is subaqueous excavation, the finished grade being about 21 ft. below lake level. After drilling and blasting, the excavation is carried on with dipper dredges. This work is being done to provide new channels and slips for the new ore docks of the Lake Shore & Michigan Southern Ry. Co. at Ashtabula Harbor.

The drill boats are about 85 ft. long by 30 ft. wide and are held in position by four spuds, one at each corner. They are equipped with Ingersoll-Sargent steam drills supported upon vertical frames having trucks to permit of the drills being moved horizontally along the edge of the boat. The drills are raised and lowered during the operations of the drill by hydraulic lifts. The boilers furnish steam for operating the drills, the pumps connected with the hydraulic lifts and the electric lighting plant and other machinery.

Drill boat "A" is equipped with three drills and drill boat "B" with two. The amount of explosive used is about ¾ lb. of 45 per cent dynamite per lineal foot of drilled hole. A hole is charged by inserting sticks of dynamite, with the exploders and battery wires attached, into the bottom of a long pipe, the battery wires leading out through a slit in the side of the pipe. This pipe is lowered into the drilled hole, the dynamite shoved down with a ramrod, and the pipe withdrawn, a wire spring clamped to the dynamite preventing its coming out of the hole. The wires are then attached to the battery and the dynamite is exploded. The operation of the other drills is not interrupted during the

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time of the firing. About ½ lb. of 45 per cent dynamite is used per cubic yard of blasted material place measure. In this class of excavation it is not necessary to drill the holes more than from 6 ins. to 1 ft. below grade.

Referring to the performances of the drill boat "B" it will be noticed that the cost of drilling and blasting at night was much less than by day. This is due to the fact that the work is done in the open lake without protection from wave action and still weather prevails more often at night, making the operation of the boat less difficult. During the day, a day breeze often springs up as the sun comes up and goes down as the sun sets. Oftentimes this breeze is fresh enough to stop operations.

Work With Drill Boat "A."—Drill boat "A" worked days only. The average depth of holes was 6.15 ft. and their average distance apart was 6.7 ft., The wages paid labor and the prices of materials were as follows, a 11-hour day being worked:

Foreman	$4.85
Drillers	3.30
Helpers	2.42
Fireman	2.20
Blacksmith	3.00
Blacksmith's helper	2.20
Coal, per ton	2.70
Dynamite, 45 per cent, per lb.	.15
Electric detonators, per dozen	.30
Tug service per transfer	5.00

The following is the record of work for the month of May, 1907:

Rock drilled and blasted 4,744 cubic yards place measure.	Total.	Per cu.yd.
2,134 lbs. of explosives at 15 cts	$ 320.10	$0.067
30 transfers at $5 by tugs.	150.10	.032
33 tons coal at $2.70	89.10	.019
Labor, drilling and blasting	320.10	.067
Lay time, due to bad weather and breakdowns.	107.68	.022
Repairs	147.04	.032
Miscellaneous	14.24	.003
Electric detonators	23.20	.005
Interest and depreciation	180.00	.038
4,744 cu. yds drilling and blasting at 28.5 cts	$1,351.46	$0.285

The drilling was done with 3¾ to 4-in. drills, the total depth of hole drilled being 2,853 ft. The total amount of explosive used was 2,134 lbs., or 0.75 lb. per lin. ft. of hole. The number of drills sharpened was 38, so that one drill was sharpened for each 75 lin. ft. of hole drilled.

Work With Drill Boat "B."—Drill boat "B" was worked day and night shifts. On the day shifts the average depth of holes was 9.1 ft. and the average distance between holes was 6.6 ft. On the night shift the corresponding figures were 9.5 ft. and 6.6 ft. The records of cost for the day shifts and for the night shifts for the month of May, 1907, are given separately.

Record of Day Shifts.

	Total.	Per cu.yd.
Rock drilled and blasted 6,460 cu. yds. place measure.		
3,219 pounds of explosives at 15 cents	$482.85	$.075
7 transfers by tugs at $5	35.00	.005
41 tons coal at $2.70	110.70	.017
Labor, driling and blastting	451.03	.071
Lay time due to bad weather and breakdowns	168.30	.026
Repairs	105.20	.016
Miscellaneous	4.80	.000
Electric detonators	22.00	.003
Interest and depreciation on plant	150.00	.023
6,460 cubic yards drilling and blasting at 23.6 cts.	$1,529.88	$0.236

The drilling was done with 3¾-in. drills, the total depth of hole drilled being 4,004 ft. The total amount of explosive used was 3,219 lbs., or 0.804 lh. per lin. ft. of hole. The number of drills sharpened was 68, so that one drill was sharpened for each 59 ft. of hole drilled.

Record of Night Shifts.

Rock drilled and blasted 6,805 cu. yds. place measure.	Total	Per cu.yd.
3,148 lbs. explosives at 15 cts	$ 472.20	$0.070
7 transfers by tugs at $5	35.00	.005
39 tons coal at $2.70	105.30	.015
Labor, drilling and blasting	370.48	.054
Lay time due to bad weather and breakdowns	193.52	.029
Repairs	38.18	.006
Electric detonators	22.20	.003
Interest and depreciations on plant	150.00	.022
6,805 cu. yds drilling and blasting at 20.4c	$1,386.88	$0.204

The driling was done with 3¾-in. drills, the total depth of hole drilled being 4,218 ft. The total amount of explosive used was 3,148 lbs., or 0.75 lb. per lin. ft. of hole.

Fuel oil is being used to a considerable extent on the Mexican Central Ry., and that company is now taking 4,000 barrels of fuel oil daily from the Mexican Petroleum Co. All new engines purchased by the Mexican Central are equipped for burning oil, and engines are being constantly remodeled in the general shops at Aguascalientes. Oil-burning engines will be soon placed in service on the Chihuahua and Guadalajara divisions of the Central. Storage tanks are being prepared at Guadalajara, Yurecuaro, Zapotian and La Vega, and metal delivery tanks are now being erected.

Application has been made to the Federal Chambers of the Swiss government for a concession on behalf of the Canton of the Grisons for the Splugen railway. The projected line, starting at Coire, will have a total length of over 52 miles. The maximum gradient is 26 per 1,000. The main tunnel through the Splugen will be 17 miles in length, out of which 8.65 miles would be on Swiss territory. The total cost of the line is estimated at $25,000,000.

The Cost of Creosoting Piles and Ties.

In our issue of July 3 we gave the itemized cost of burnettizing ties, the total cost being $2.50 per 1,000 ft. B. M., or 10½ cents per tie of 7 x 9 ins. x 8 ft. The following data relate to the cost of creosoting ties and piles. Creosoting is a much more expensive process, but the burnettizing treatment is of no use where timber is constantly exposed to the action of water, as is the case wherever piles are used. Water leaches out the zinc chloride in a comparatively small time whenever the timber is constantly submerged, and, even where it is exposed to frequent rains the zinc chloride is dissolved little by little until there is no longer enough left in the timber to protect it from the fungus of decay. Could some one devise a method of filing the outer pores of burnettized wood with some water-proof compound it would be possible to use the zinc chloride for preserving the body of timber that is exposed to water. For example, it might be practicable to treat the surface of burnettized timber with the Sylvester process which has been so successfully used in water-proofing masonry, namely, by coating with soft soap and alum in such a manner as to fill the pores with a curd like precipitate. Indeed, it might be practicable to treat timber, first with zinc chloride and subsequently with creosote, so that the creosote would form the outer protective shell.

The following costs represent the average of a year's work in a plant having a capacity of 500,000 cu. ft., or 6,000,000 ft. B. M. per annum.

The cost of treating the timber was as follows, per cu. ft.:

	Cents per cu. ft.
1.05 gals. creosote at 11.5 cents	12.08
Fuel ($3.50 per ton) and other supplies	1.82
Labor	3.75
Depreciation, maintenance and repairs	1.50
Total	19.15

This is equivalent to $16 per 1,000 ft. B. M., which is more than six times as expensive as burnettizing.

A 7 x 9 ins. by 8 ft. tie contains 3.5 cu. ft., hence the cost of creosoting each tie was 67 cents, as compared with 10½ cents by the zinc chloride process (burnettizing). About 300,000 lin. ft. of piles were creosoted, and it was found that the piles average 1.11 cu. ft. of timber per lin. ft. of pile. Hence the cost of creosoting was 21¼ cents per lin. ft. of pile.

In analyzing the above costs per cu. ft. it will be noted that the item of depreciation and maintenance is 1.5 cents per cu. ft., which is equivalent to $1.80 per M. This item is based on an allowance of 10 per cent per annum for depreciation of a $75,000 plant, plus current repairs and insurance.

For comparative figures on the cost of creosoting the reader is referred to Gillette's "Handbook of Cost Data," page 489.

Methods Employed in Reconstructing the Battery Tunnel of the New York Rapid Transit Railway.

The Battery tunnel of the New York Rapid Transit railway is a twin tube cast iron and concrete lined tunnel extending from Battery Park, Manhattan, to the foot of Joralamon street, Brooklyn. The length of the tunnel under the river is 6,550 ft., each tube is 15½ ft. inside diameter and the two tubes are parallel and 25 ft. apart. The material penetrated is rock and hard earth for all but about 1,200 ft. which are in fine stand standing well when confined but being very unstable when disturbed and water soaked. In driving the work through the fine sand much trouble was had in keeping the shields to grade; the shields would dip and before the dip would be controlled the advancing tunnel had been carried below grade, and likewise in raising the shield to correct the dip it would rise and continue above grade for a space. The tunnel in consequence exhibited a succession of humps and dips behind the shield. These humps and dips were increased by settlement due to leakage of material in from the working face and through uncaulked joints in the lining. The variations from theoretical grade due to the causes mentioned are summarized as follows in a report on the work by Mr. Nelson P. Lewis, M. Am. Soc. C. E., to the Board of Estimate and Apportionment of New York City:

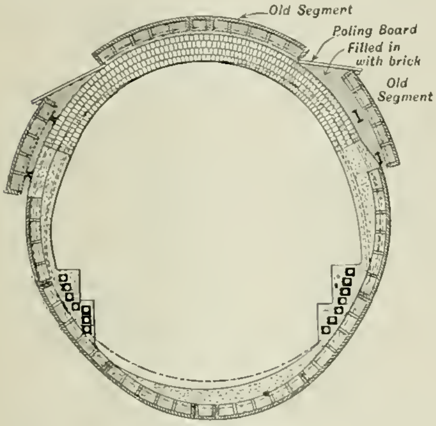


Fig. 1—Sketch Showing Method of Rectifying Grades of Battery Tunnel.

"North Tube—Beginning at the Brooklyn end the bottom of the tube is about 4 ins. below the theoretical grade, this variation decreasing toward the west to a point just east of Garden place, where the tube suddenly rose to 9 ins. above grade, then gradually approached true grade, crossed it about 100 ft. east of Hicks street, and 100 ft. west of Hicks street dropped to 28 ins. below grade, this being the greatest departure. Up to this point the tunnel is wholly or in part above water level. The true grade was recovered in the next 100 ft., and from the bulkhead line the tube bottom was mostly above grade, the maximum distance being about 10½ ins., while at one point it fell 9 ins. below the grade. After crossing the bulkhead line the tube continued above the theoretical grade for over 500 ft., the maximum variation being 17 ins. It then ran very closely to the true grade for about 500 ft., and within the next 100 ft. it reached a maximum of 18 ins. below grade. For the remaining 200 ft. before the rock reef was reached the grade line was somewhat irregular.

"South Tube—The grade of this tube from its easterly end shows slight variations from the true grade, with a maximum of about 5 ins. above and below, but after passing Hicks street there is, as in the case of the north tube, a more noticeable departure, dropping to about 23 ins. below the true grade, which, however, was quickly recovered, and was closely followed to the bulkhead line, the maximum variations in this distance, which is about 900 ft., being 3 ins. above and somewhat less below the true grade. In both tubes the maximum departure from grade occurred just west of Hicks street, or at the point where the tubes became wholly submerged."

To get a true grade for the track necessitated, of course, the filling of the dips and this meant that the required clearance would be seriously infringed upon. Reconstruction of parts of the finished tunnel were, therefore, necessary. At the same time it was deemed desirable to ensure the future stability of the tunnels by supporting portions of the tubes in the soft material. The reconstruction work illustrated here, therefore, includes first the work of rectifying the grades, and, second, the work of supporting the tubes against further settlement.

Rectification of Grade.—The work of rectifying the grade consisted of elevations and depressions of the roof and invert by removing some of the lining segments and replacing them with other construction. This work was done under air pressure. So far as the invert changes were concerned, the task was very simple; the old segments were removed piecemeal and new ones inserted. The roof alterations were more complex operations.

A working platform or staging with a clear trackway beneath was first built in the lower part of the tunnel. From this staging the necessary roof segments were unbolted and then jacked upward and outward as indicated in Fig. 1. The roof segments were first jacked upward and poling boards driven as shown to support the earth above the side segments as they were jacked outward. When the segments had been jacked to the required position they were supported on radial struts carried on timber arch centers.

The lower part of the tunnel was then relined with concrete about up to the haunches. As shown by the drawing the upper portion of the concrete lining on each side was reinforced with curved bars; there were three 1-in. reinforcing bars for every 22-in. ring. The roof arch was constructed of brick and the space between it and the old segments was brick filled.

About 2,676 ft. of invert and 210 ft. of roof arch were reconstructed as described between April, 1906, and June, 1907, with a force of 16 men.

Underpinning Tunnels.—The construction designed for underpinning the tunnels is shown by Fig. 2; it consists of a series of transverse concrete pile bents spaced along the tube at irregular intervals of about 50 ft. Each bent consists of two concrete-filled tubular steel piles, spaced 7 ft. on centers transversely, sunk to either hardpan or rock and capped with a concrete cradle formed around the bottom of the tunnel shell. The piles are 20 ins. in diameter, and are made of ½-in. steel plate in sections 5 ft. long. The sections are simply butted, and are connected by splice strips riveted or bolted over the joint, outside. A 4-in. jet pipe passes through the center. Four vertical rods of 1-in. square steel, in lengths corresponding to the shell sections, are arranged in the interior of the pile in the manner of reinforcing rods, and at the bottom of the pile are brought to a point. The successive lengths of rod are jointed by lapping about 12 ins.

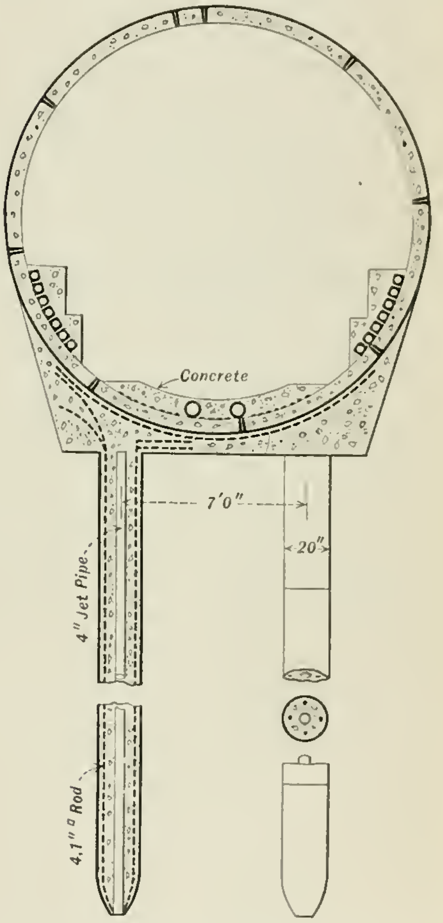


Fig. 2—Sketch Showing Method of Under-pinning Battery Tunnel.

To put down a bent, three plates of a lining ring are removed, one being broken by wedges or jacks to enable the other two to be taken out. The soil below is then excavated to form a trench with level bottom, about 10 ft. long in a direction transverse to the tunnel and extending under the adjacent ring on either side. Before the foundation is completed, plates are taken out of these adjoining rings also, there being usually a total of from seven to nine segments taken out. The sides of the trench do not require sheeting if the air pressure is kept up to the full hydrostatic head. The bottom section of each of the two piles is then set in place, its lower part being filled with concrete. Water is pumped through the 4-in. jet pipe and the piles are forced down by hydraulic jacks butting against the roof by means of distributing timbers. When one section is sunk another is set on top of it and joined to it. Concrete is then filled into the pile to about the middle of the second section and the work of sinking resumed. As successive sections are added, the reinforcing rods and the jet pipes are extended. When the piles reach hard bottom the piles are completely filled, the reinforcing rods splayed out, and the entire trench filled with concrete as shown in Fig. 2. The surface of the concrete is kept 4 to 6 ins. below the outside of the lining in order to allow the last plate to be slipped in from the outside. Then the lining segments are replaced and bolted up, and finally the space between concrete and lining is grouted under pressure.

The work of reconstruction as described is being done by the New York Tunnel Co. as contractors, under the direction of the engineers of the Rapid Transit Commission.

The total outlay on county roads in the Province of Ontario, Canada during the ten years, 1896-1905, represents a value of $21,000,000. This is made up of cash expenditure of $10,432,902 and 10,510,900 days of statute labor. This includes the expenditure of townships and only a portion of that made by counties on country highways. The expenditure on town and city streets represents a large additional amount. The maintenance of roads by statute labor is gradually being done away with, and townships are putting their road work on a cash basis, centralizing the supervision under one to four commissioners, using labor-saving machinery, building better bridges, and in many ways seeking greater permanence and durability for the highways.

Commercial service was begun Aug. 1 over the new all-American cable laid directly from New York to Colon by the Central and South American Cable Co. The contract for the new cable, which is 2,263 knots long, was let Jan. 19, 1907.

Summary of Tests on Reinforced Concrete Beams at the University of Wisconsin Laboratories.

In our last issue we printed an abstract of a portion of a bulletin issued by the University of Wisconsin giving the results of some tests on reinforced concrete beams. In this issue the remainder of the abstract of the bulletin is given. The bulletin, in addition to giving the general observations on the action of reinforced concrete beams under stress, also gives separate discussions to particular phases of the subject, such as: The early appearance of minute cracks on the tension side of beams; position of neutral axis; efficiency of different methods of reinforcing in preventing inclined tension failures; and tests on sixteen 8 x 11 in. x 13 ft. beams. The first two subjects were given in our issue of last week, and the last two subjects are given herewith.

VARIOUS METHODS OF REINFORCING.

The proper method of reinforcing a beam against the various internal stresses is a very important one, and as yet has not been satisfactorily determined. When reinforced concrete first came into general use it was thought that horizontal reinforcement was sufficient, and the peculiar features which often occurred were usually ascribed to pulling out the rods, an idea which led to the invention of the various forms of deformed bars now on the market. It has been found, however, that even beams reinforced with deformed bars often fail along inclined cracks, and that something besides horizontal rods is necessary to prevent such failures. Stirrups have been used extensively with this end in view, but, although they assist in carrying the internal stresses to some extent, their use in the usual manner will not always prevent inclined tension failures.

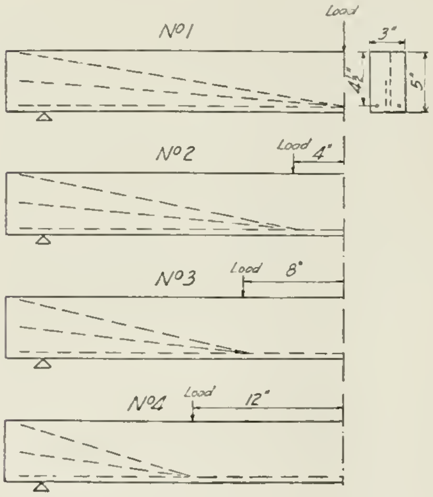


Fig. 5.

Messrs. Gilman and Kahn used stirrups in a number of their beams, and, although these beams were found to be somewhat stronger than those without stirrups, they still failed to develop the full compressive strength of the concrete or the tensile strength of the steel.

Another method used in their tests, and also in the succeeding ones, was to bend the horizontal rods at an angle of 45 degrees at equal intervals between the loading points and the support. The results of all these tests are given in Table III. The beams were all 5x3 ins. in section with a span length of 48 ins. made of a 1:2½ mortar, and reinforced with four ¼-in. round rods. The positions of the loads are given in the table. The rods were bent up at the quarter points between loads and supports. In beams 13 to 24, inclusive, the first rod was bent at the point of loading, the second rod was bent at one quarter of the distance from this point to the support, and so on; thus, no rod was horizontal all the way through. In beams 1 to 12, inclusive, the first rod was bent at the point where the second one was bent in the previous beam, so that in each beam one rod was straight over its full length. In both cases all of the four rods were horizontal between loads. The four rods were tied in a bundle so as to make the section as nearly symmetrical as possible with respect to a longitudinal plane through the center of the beam.

With the exception of three of the beams with loads at or near the center all these beams failed by inclined tensions, this being the favorite method of failure of all beams reinforced with only horizontal rods. The failures occurred on lines through the bent rods, the rods slipping sooner or later as the bent portions were not long enough to offer sufficient adhesion to carry the inclined stresses. Strictly vertical shear failures were obtained in several of the beams of this set which had the loads applied very close to the support. The inclined tension failures are here called shear failures and the same term is also used in all the other tables, so that, except for the several beams in Table III, which failed by vertical shear, wherever a failure is called a shear failure, inclined tension is meant.

Another method of bending the rods was tried with better results. This series consisted of four beams reinforced as shown in the diagram Fig. 5 with two rods running straight through and two bent at the loading points. The inclined cracks as they usually occur in a concrete beam are approximately perpendicular to the direction of these rods; therefore, these rods should be very efficient in preventing this failure. This was actually found to be the case. Series G, the results of which are given in Table IV, was designed for the special purpose of determining this in a preliminary way and all the large beams made later were provided with this system of reinforcement.

Three of the beams of Series G failed in tension at the center, while similar beams with the same loading and provided with only straight rods or rods bent at an angle of 45° failed by inclined tension. In the last beam G-4 the loads were too near the supports to give a moment failure.

In the tests of the 8x11-in. beams this method of reinforcement gave equally as good results. All the beams of the 1:2:5 concrete except No. 13 failed by tension within the middle third of the beam. In every case the usual inclined cracks near the ends appeared but were prevented from developing by the bent rods. Two per cent reinforcement was stressed to its elastic limit in these beams. In the case of No. 13 failure near the end occurred after the cracks near the center had opened up considerably and the steel had apparently been stressed to its elastic limit. In fact this beam carried a greater ultimate load than its duplicate No. 15, which failed by tension near the center. It is desirable to emphasize the fact that this failure was not caused by a pulling out of either the inclined or straight rods. The final failure occurred by a prying up of the upper half of the beam at the end, which seems to indicate that stirrups would be very efficient at this point in connection with the inclined rods.

TABLE III.—*Strength of beams with varying points of loading.*

5 in. x 3 in. x 48 in. span; net depth 4½ in. 1.44 per cent steel, 60,000 lbs. elastic limit. 1:2½ mortar.

NOTE.—Beams marked "A" had rods bent up at an angle of 45° at quarter points between loads and supports. Beams marked "G" are shown in Fig M—3.

No. of beam.	Max. moment inch-pounds.	Max. shear pounds per sq. in.	Kind of failure.	Distance of loads from supports, inches.
A 1	39,400	110	Moment	Center.
A 2	47,100	140	Shear	22
A 3	43,400	145	Moment	20
A 4	39,600	145	Shear	18
A 5	39,200	165	Shear	16
A 6	36,700	175	Shear	14
A 7	41,600	230	Shear	12
A 8	48,000	320	Shear	10
*A 9	32,800	270	Shear	8
*A10	24,600	270	Shear	6
*A11	26,600	440	Shear	4
*A12	11,100	370	Shear	2
A13	39,600	110	Shear	Center.
A14	34,800	95	Moment	Center.
A15	34,000	115	Shear	20
A16	36,000	120	Shear	20
A17	35,200	145	Shear	16
A18	30,800	130	Shear	16
A19	30,300	170	Sbear	12
A20	27,300	150	Shear	12
A21	24,000	200	Shear	8
A22	24,300	200	Shear	8
A23	22,000	370	Shear	4
A24	19,600	330	Shear	4
*G 1	34,800	100	Moment	Center.
*G 2	36,000	120	Moment	20
*G 3	36,800	155	Moment	16
*G 4	29,400	165	Shear	12

*50,000 lbs. elastic limit steel.

Three of the 1:3:6.5 beams failed by inclined tension. These failures were perhaps due to slipping of the inclined rods. By comparing these three beams, Nos. 10, 12 and 16, with the others of this set it is seen that similar beams failed by compression at the center with practically the same or smaller loads, and that, therefore, these three beams had probably reached their full compressive strength when failure near the end occurred.

Anchored Rods—It has been claimed that beams with straight rods anchored at the ends are stronger than without the anchorage and that the horizontal cracks often observed in the plane of the reinforcement are due to pulling out of the rods. With a view to investigating this, four beams were made with horizontal rods anchored at the ends. The anchorage consisted of a rectangular bar of steel with holes bored through to allow it to be slipped over the ends of the reinforcing rods. The rods were then bent back over this bar so that they had a firm bearing. The loads were applied at 12, 16, 20 and 24 ins. from the supports. All four beams failed in the manner typical of beams with only horizontal reinforcement.

A comparison of the strengths of these beams with those of Series B is given in Table IV. Since the two sets of beams were exactly alike except for the anchorage, the results are directly comparable.

It would be rash to draw final conclusions from these few tests, but they seem to show first, that the horizontal crack in the plane of the reinforcement is not due to the pulling of the concrete upwards away from the rods, and therefore cannot be prevented by anchoring the rods at the ends; and second, that anchoring the rods does not make the beams stronger with the proportions here used.

LARGE BEAM TESTS.

Some mention has already been made of 8x11-in. beams, but it was thought best to separate the results of these tests somewhat from the smaller beams as they constitute a separate investigation.

These beams were 8x11 ins. in cross section and 13 ft. long, the net section above the center of the steel being 8x10 ins. and the span length 12 ft. Five, six, seven and eight 1½-in. round rods were used, corresponding approximately to 1.25, 1.50, 1.75 and 2.00 per cent reinforcement, respectively. The odd numbered beams were of 1:2:5 concrete, corresponding to a 1:2 mortar filling the voids in the broken stone, plus 15 per cent excess. The even numbered beams were of 1:3:6.5 concrete, corresponding to 1:3 mortar filling the voids in the broken stone, plus 15 per cent excess. Duplicate beams were made, one having the rods exposed over the middle 4 ft. and the other having the rods entirely enclosed as is ordinarily done. Figure 6 is a diagram of these beams.

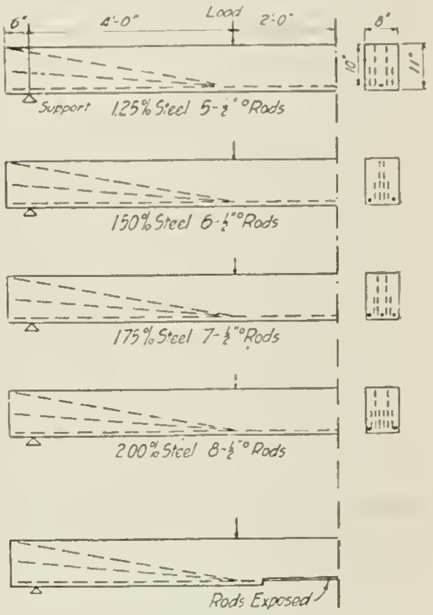


Fig. 6.

In every beam in which the steel in tension was weaker than the concrete in compression visible cracks developed in the tension side of the beam at intervals of from 4 to 6 ins. In these beams the concrete failed in compression after the tension had opened up considerably. In those beams with an excess of metal, which failed strictly by compression, the failure could be noticed until almost the maximum load had been reached. The first noticeable crack in the beams occurred at loads varying from 4,000 lbs. to 8,000 lbs. according to the percentage of steel.

An interesting phenomenon was observed in these as well as in the small beam tests. Careful observation showed that in beams which failed by inclined tension, the *visible* cracks did not open up first on the tension face of the beam as commonly supposed, but began to develop at approximately the point marked "A" in the accompanying diagram (Fig. 7). From that point it worked its way up to about the center of the beam and down to the plane of the reinforcement and along this plane to the end of the beam. The crack at "B" opened up at about the same time as the horizontal crack or a little earlier. In beams with inclined rods the horizontal cracks in the plane of the reinforcement very seldom occurred,

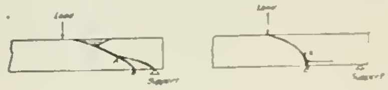


Fig. 7.

but the other cracks developed in the same order. The same phenomenon has also been observed in the failure of Tee beams tested recently in the University of Wisconsin laboratories.

Table V gives the general results of these tests. In Fig. 8 the tests are plotted with references to $\frac{M}{bd^2}$ and P. The results are fairly represented by the heavy straight line whose equation is $\frac{M}{bd^2} = 143 + 270$ P.

By using this straight line, a computation of the ultimate strength of two of the small 5x3-in. beams which failed intension, checked the actual strength within 5 per cent and 12 per cent, respectively, which is very close considering the great range in section and span and other different conditions.

Table IV.—*Comparison of strength of anchored and unanchored-rod beams.*

No. of beam.	Max. Load.	
	Anchored.	Not anchored
1 .	3300	3500
2 . . .	3600	3700
3	3600	4300
4	3600	4900

The dotted line in Fig. 8 shows the theoretical curve assuming a straight line variation of stress and assuming 2,000,000 as the coefficient of elasticitity of the concrete, which is probably not greatly in error. The yield point of the metal was taken at its actual value of 42,500. With these assumptions the following is the theoretical equation for determining $\frac{M}{bd^2}$

$$\frac{M}{bd^2} = \frac{SP}{100}\left[0.05P + 1 - \tfrac{1}{3}\sqrt{0.15P + 1 - 1}\right]$$

P = Per cent of steel.

S = Yield point of metal.

The equation for the part of the curve between P = 1 and P = 2, assuming it to be a straight line, which it is approximately, is $\frac{M}{bd^2} = 50 + 320$ P. The experimental points in this figure were obtained from a very limited number of tests, each point representing only a single test, and consequently the slope of the line through them might be found to be somewhat different if a larger number of points were plotted. For practical computations the straight line formula given above would be just as accurate as the more exact theoretical formula, but, of course, a different formula would he obtained for each different quality of steel.

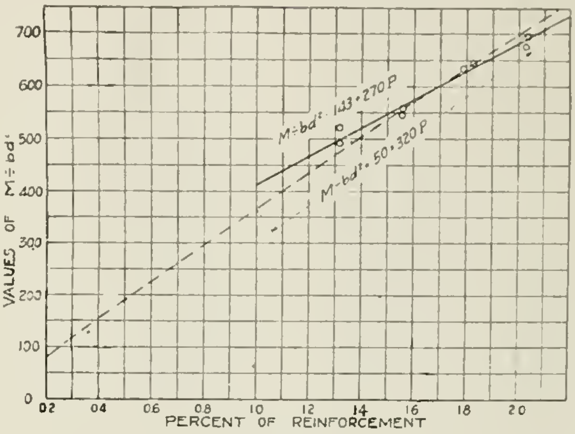


Fig. 8.

CONCLUSIONS.

The various conclusions which have been drawn in the course of this discussion may be summarized as follows:

Table V.—*General table for large beams.*

Beams 8 in. x 11 in. x 12 ft. span, net depth 10 in.; loads at third points; 42,500 lbs. elastic limit steel; 4 in. cubes; all test pieces stored in air.

No. of beam	Kind of con-crete.	Per cent steel.	Max. load.	Kind of failure.	No. of ½ in. round rods.		Max. unit stress in steel.	Max. unit stress in concrete.		Ratio $\frac{S_1}{S_2}$	Max. unit verti-cal shear.
					Strg't	Bent.		Beam S_1	Cube S_2		
1	1:2:5	1.32	15,140	Tens.	1	4	45,600	2,220	1,170	1.90	95
3	1:2:5	1.32	15,940	Tens.	1	4	46,200	2,700		. .	100
5	1:2:5	1.56	17,000	Tens. .	2	2	43,500	2,300	1,420	1.62	106
7	1:2:5	1.56	17,360	Tens. . .	2	4	43,200	2,540	1,600	1.59	108
9	1:2:5	1.79	20,000	Tens. .	3	4	44,300	2,600	1,310	1.98	125
11	1:2:5	1.83	19,900	Tens. .	3	4	40,200	3,000	1,290	2.32	124
13	1:2:5	2.04	22,600	Shear. .	2	6	42,100	3,020	1,620	1.86	141
15	1:2:5	2.03	22,100	Tens. .	2	6	41,500	2,860	1,560	1.83	138
2	1:3:6:5	1.29	16,200	Tens. .	1	4	48,000	2,170	990	2.19	101
4	1:3:6:5	1.28	14,000	Tens. .	1	4	41,700	1,810	950	1.91	87
6	1:3:6:5	1.52	15,000	Comp.	2	4	38,400	1,790	950	1.88	94
8	1:3:6:5	1.55	10,400	Comp.	2	4	27,200	1,150	780	1.48	65
10	1:3:6:5	1.78	12,000	Shear. .	3	4	27,000	1,330	780	1.70	75
12	1:3:6:5	1.80	14,200	Shear. .	3	4	36,100	1,910	1,020	1.87	89
14	1:3:6:5	2.06	13,800	Comp.	2	6	27,500	1,510	1,020	1.48	86
16	1:3:6.5	2.06	16,000	Shear. .	2	6	31,200	1,860	1,050	1.77	100

(1) Concrete reinforced with steel will not stretch more before cracking than plain concrete; and the unit elongation of the steel when the first minute crack appears is not greater than from 0.0001-in. to 0.0002-in., corresponding to a unit stress in the steel of 3,000 to 6,000 pounds per square inch. Consequently the tensile resistance of concrete should not be taken into consideration in reinforced concrete design.

(2) Until a method has been devised by means of which the coefficient of elasticity of concrete in a beam can be accurately determined, or until sufficient systematic tests have been made for the special purpose of determining the position of the neutral axis for different concretes and different percentages of steel, the neutral axis may for practical purposes be assumed to be 0.55 of the depth of the beam above the center of the steel for working loads on beams of rock concrete of good design; that is, where the concrete in compression is not excessively strong relative to the tensile resistance of the steel, and vice versa. This makes the lever arm of internal stresses 0.85 of the depth.

(3) Horizontal reinforcement is not sufficient in beams of ordinary dimensions, but some provision must be made to transfer the tensile stress from the steel into the compressive area of the concrete.

(4) This can be satisfactorily accomplished for simple beams by a method similar to that used in the 8x11-in. beams of these tests. In most reinforcements heretofore used with bent rods the angle of inclination with the horizontal has been too large and consequently the adhesive area of the rods was too small. Numerous tests on both large and small beams have shown that these methods are not effective in preventing inclined tension failures.

(5) Anchoring the horizontal rods at the ends of a simple beam is of no benefit.

(6) With sufficient provision made for shearing stresses, the strength of a concrete beam can be accurately calculated if the yield point of the metal and the compressive strength of the concrete are known. The maximum compressive stress on the outer fiber may be safely taken somewhat larger than the stress as determined in cube form.

(7) With a good concrete and medium steel and with equal factors of safety for concrete and steel the per cent of metal may be made as high as 1.75 or 2 per cent without making the tension side stronger than the compressive side.

Methods and Costs; Some Old, Some New.

Erecting Steel Stack.—Two gin-poles were used in erecting a steel stack weighing 16 tons. The stack is 140 ft. high and 10 ft. in diameter at the base, tapering to 5½ ft. at a point 12 ft. above the base. The stack was riveted in 30 ft. lengths at the builders' shop and was thus conveyed to the site. The two gin-poles were set up, one on each side of the concrete foundation and securely guyed. Tackles were run through quadruple blocks to the head of the gin-poles, and through similar blocks at the base. The sections of stack were laid between the poles and riveted together. The completed stack was then lashed just above the center of weight and the tackle attached and the stack hoisted by two gangs of men operating hand winches. The stack assumed nearly a vertical position as it was lifted up, and the lower portion was then pushed in over the base-plate and bolts inserted.

"Home Made" Cableway.—In constructing a culvert under a high embankment on a railroad, the cableway described below was used in delivering materials to the base of the embankment. The embankment was 70 ft. high and the culvert constructed through it was a 5 ft. span, full centered concrete arch. All materials for the construction of the culvert were delivered beside a railroad track at the top of the embankment. The cableway consisted of a wire rope passing through a double block at the top, attached to a post sunk in the embankment, the lower end of the rope being attached to another post at the site of the work. On this rope ran two boxes, having deep drop bottoms, and hung from the cable by small snatch blocks. These boxes were connected by a 1¼ in. rope, so adjusted that when one box was at the top the other stood over the concrete mixing board at bottom. When the loaded box descended it pulled up the empty one. The speed of descent of the loaded box was controlled by a brake stick. The broken stone was taken from the stone bin by means of a chute.

Grouting Under Floor of a Lock Gate.—The front gate of a canal lock rested upon a concrete floor supported by piling driven into quicksand. Transverse rows of sheet piling had also been driven. In testing the lock this front gate failed, owing to water running under the foundation where the quicksand offered insufficient resistance. The front gate was not wrecked in any way by the failure except that the earth blew out from under it.

To remedy the trouble it was decided to replace the blown out material under the flooring with cement grouting. It was also decided to drive a transverse row of steel sheet piling to cut off any leakage under the lock. Accordingly 100 steel sheet piles, 38 ft. long, were driven to grade and their heads married into the cement floor and abutments. Several holes were then cut through the concrete floor of the lock, on the river side of the miter sill, and a short joint of 8 in. iron placed in each, with a flange at the top just flush with the surface of the floor. These were set in concrete so as to be left in place after they had been used to fill the voids under the floor caused by the blow-out. A 25-ft. pipe 8 in. in diameter was bolted in turn to three short joints. A rich, slow-setting, cement grout was then poured into the standpipe until it appeared at the top of the pipe. Difficulty was encountered at the first hole as none of the grout seemed to have found its way under the floor by gravity. Accordingly a plunger, made of a length of 4 in. pipe with a piston head fitted on the lower end was used, and with the aid of a steam hammer about 9 cu. yds. of grout was forced in. When light blows of the hammer failed to force any more grout in, the first hole was sealed, and the same process repeated on the remaining holes.

Thawing Out Frozen Ground.—Various methods are used in thawing out frozen ground in mining operations in Alaska. The direct application of jets of dry steam to the gravel bank, through the agency of driven pipes has been found to be the most efficient method in general practice for thawing frozen gravel. Thawing gravel underground by wood fires is used in districts where transportation facilities will not permit the bringing in of boilers. According to experience on Deadwood Creek, Birch Creek District, the efficiency of a wood fire in creek ground was as follows: A fire taking 3-5 cord of wood at $12 a cord, is built against the face of the bank. The pile of wood will be 18 ins. wide, 2 ft. high, and 25 ft. long. Stones are laid up over the pile and a space is left to light the fire. The fire is lighted at 5 p. m. and left to burn until 8 a. m. the next day. The stones, which quickly get hot, are regarded as most efficient in thawing. On a 4-ft. thickness of gravel this amount of fire will thaw, in the time specified, from 5 to 6 cu. yds. of gravel. This is at the rate of 9.2 cu. yds. thawed to the cord of wood, which is considerably less efficient than the method of thawing with steam. In thawing by the direct application of steam jets, the method of drifting employed in creek claims exceeding 15 ft. in depth where solidly frozen ground occurs, is as follows: A 20-h. p. boiler, capable of running 10 steam points, is put on the ground, and frequently one or two extra long points are provided for sinking holes. These long points, from 10 to 12 ft. in length, are not so strongly made as the 5-ft. points used in the drifting operations. In some cases pieces of ½-in. hydraulic pipe are used. The point is set up on the ground and steam or hot water is turned on. The time for sinking a hole by this method to bed rock is from 24 to 48 hours. If large, flat stones are encountered in the gravel underlying the muck it is sometimes advisable to use strong, specially made points to prevent breaking. The average radius of a vertical shaft thus thawed by a single point is 2 ft., and the hole when cleaned out has a cylindrical or tube shape. The following example is given as illustrating the efficiency of thawing by this method: Points of Dawson manufacture, 5 ft. long, costing $15 each laid down, were used in crossheads of four. They were put in at distances of from 2½ to 3 ft. apart. The points were started with hot water, and it took three hours to drive them in. A 12-h. p. boiler supplied the steam for 10 points, ¾ of a cord of wood being burned on the night shift, when the thawing was done. In twelve hours the 10 points thawed a block of gravel 30 ft. in length by 5 ft. in height by 6 ft. into the bank—an average of 3.3 cu. yds. to the point.

Cableway Used in Laying a Water Main.—A cableway strung across the stream was used in laying a 15 in. water main under a small river. Hub and spigot cast iron pipe in 12 ft. 1 in. lengths, with a wrought iron hoop shrunk on at the sockets was used; this pipe weighed 1,850 lbs. per length. Five ball and socket joints were required to allow the main to assume the profile of the river bed. As cofferdams could not be built a trench was dredged across the river, and a cableway anchored to two piles on each bank, a third pile being placed at each anchorage to act as a guide. The width of the river was 100 ft., so that eight lengths of pipe with ball and socket joints were enough to cross it. Two lengths of pipe were first placed together and a lead joint made between them, half of a ball and socket joint being attached to each end of this 2-length section. This section was then hauled across the river by means of the cableway and lowered nearly to position on the bottom between two barges, its weight being transferred to these barges. Another 2-length section was then made, hauled across the river and its weight also transferred to the barges after the ball and socket joint between the two sections had been made. The third 2-length section was suspended from on the cableway, while the last section was held by a derrick on the bank. The eight lengths were then lowered simultaneously by means of blocks from which they were suspended, the end lengths being held above water until connections could be made with the pipe line on each side of the river.

Proposed British Standard Rules for the Design of Reinforced Concrete Buildings.

A set of rules for the guidance of building design has been formulated and published by the British Joint Committee on Reinforced Concrete. The work of this committee was inaugurated about two years ago by the Royal Institute of British Architects. In October, 1905, this society invited a number of British engineering organizations and governmental bureaus to co-operate with it by appointing representatives on a joint committee, the work of which was to be the production of a good working guide for the design of reinforced concrete building work. A number of those invited complied with the invitation and a committee of 16 members representing six separate organizations was organized with Sir Henry Tanner as chairman and Prof. W. C. Unwin as vice-chairman. As indicated above this committee has formulated and published the code of rules it was organized to prepare. As a matter of general interest we reprint these rules here with a brief discussion on some of their special features:

1. Reinforced concrete is used so much in building and engineering construction that a general agreement on the essential requirements of good work is desirable. The proposals which follow are intended to embody these essentials, and to apply generally to all systems of reinforcement.

Good workmanship and materials are essential in reinforced concrete. With these and good design structures of this kind appear to be trustworthy. It is essential that the workmen employed should be skilled in this class of construction. Very careful superintendence is required during the execution of the work in regard to—

(a) The quality, testing and mixing of the materials.

(b) The sizes and positions of the reinforcements.

(c) The construction and removal of centering.

(d) The laying of the material in place and thorough punning of the concrete to ensure solidity and freedom from voids.

If the metal skeleton be properly coated with cement, and the concrete be solid and free from voids, there is no reason to fear decay of the reinforcement in concrete of stone, gravel, cinder, coke-breeze, etc., made with clean, fresh water.

2. The by-laws regulating building in this country require external walls to be in brick, or stone, or concrete of certain specified thicknesses. In some places it is in the power of the local authorities to permit a reduced thickness of concrete when it is strengthened by metal; in other districts no such power has been retained. We are of opinion that all by-laws should be so altered as to expressly include reinforced concrete amongst the recognized forms of construction.

A section should be added to the by-laws declaring that when it is desired to erect buildings in reinforced concrete complete drawings showing all details of construction and the sizes and positions of reinforcing bars, a specification of the materials to be used and proportions of the concrete, and the necessary calculations of strength based on the rules contained in this report, signed by the person or persons responsible for the design and execution of the work, shall be lodged with the local authority.

3. *(a)* Floors, walls and other constructions in steel and concrete formed of incombustible materials prevent the spread of fire in varying degrees according to the composition of the concrete, the thickness of the parts, and the amount of cover given to the metal.

(b) Experiment and actual experience of fires show that concrete in which limestone is used for the aggregate is disintegrated, crumbles and loses coherence when subjected to very fierce fires, and that concretes of gravel or sandstones also suffer, but in a rather less degree. The smaller the aggregate the less the injury. The metal reinforcement in such cases generally retains the mass in position, but the strength of the part is so much diminished that it must be renewed. Concrete in which coke-breeze, cinders or slag forms the aggregate is only superficially injured, does not lose its strength, and in general may be repaired. Concretee of broken brick suffers more than cinder concrete and less than gravel or stone concrete.

(c) The material to be used in any given case should be governed by the amount of fire resistance required as well as by the cheapness of, or the facility of procuring, the aggregate.

(d) Rigidity attached web members, loose stirrups, bent-up rods, or similar means of connecting the metal in the lower or tension sides of beams or floor slabs (which sides suffer most injury in case of fire) with the upper or compression sides of beams or slabs not usually injured are very desirable.

(e) For main beams a covering of 1½ to 2 ins. of concrete over the metal reinforcement appears from experience in actual fires to afford ample protection to the structural parts. In floor slabs the cover required may be reduced to 1 in. All angles should be rounded or splayed to prevent spalling off under heat.

(f) More perfect protection to the structure is required under very high temperature, and in the most severe conditions it is desirable to cover the concrete structure with fire-resisting plastering which may be easily renewed. Columns may be covered with coke-breeze concrete, terra-cotta, or other fire-resisting facing.

Materials.—4. Only Portland cement complying with the requirements of the specification adopted by the British Engineering Standards Committee should be employed; in general the slow-setting quality should be used. Every lot of cement delivered should be tested, and in addition the tests for soundness and time of setting, which can be made without expensive apparatus, should be applied frequently during construction. The cement should be delivered on the works in bags or barrels, bearing the maker's name and the weight of the cement contained.

5. The sand should be composed of hard grains of various sizes up to particles which will pass a quarter-inch square mesh, but of which at least 75 per cent should pass ⅛-in. square mesh. Fine sand alone is not so suitable, but the finer the sand the greater is the quantity of cement required for equal strength of mortar. It should be clean and free from ligneous, organic or earthy matter. The value of a sand cannot always be judged from its appearance, and tests of the mortar prepared with the cement and the sand proposed should always be made. Washing sand does not always improve it, as the finer particles which may be of value to the compactness and solidity of the mortar are carried away in the process.

6. The aggregate, consisting of gravel, hard stone, or other suitable material, should be clean and angular, varied in size as much as possible between the limits of size allowed for the work. In all cases material which passes a sieve of a ¼-in. square mesh should be reckoned as sand, the maximum allowable size is usually ¾ in. The maximum limit must always be such that the aggregate can pass between the reinforcing bars and between these and the centering. The sand should be separated from the gravel or broken stone by screening before the materials are measured.

7. In all cases the proportions of the cement sand and aggregate should be separately specified in volumes.

As the strength and durability of reinforced concrete structures depend mostly on the concrete being properly proportioned, it is desirable that in all important cases tests should be made as described herein with the actual materials that will be used in the work before the detailed designs for the work are prepared.

In no case should less dry cement be added to the sand when dry than will suffice to fill its interstices, but subject to that the proportions of the sand and cement should be settled with reference to the strength required, and the volume of mortar produced by the admixture of sand and cement in the proportions arranged should be ascertained.

The interstices in the aggregate should be measured and at least sufficient mortar allowed to each volume of aggregate to fill the interstices and leave at least 10 per cent surplus.

For ordinary work a proportion of one part cement to two parts sand will be found to give a strong, practically water-tight mortar, but where special water-tightness or strength is required the proportion of cement must be increased.

The amount of cement added to the aggregate should be determined on the work by weight. The weight of a cubic foot of cement for the purpose of proportioning the amount of cement to be added may be taken at 90 lbs.

8. The metal used should be steel having the following qualities:

(a) An ultimate strength of not less than 60,000 lb. per square inch.

(b) An elastic limit of not less than 50 per cent, or more than 60 per cent of the ultimate.

(c) An elongation of not less than 22 per cent in the lengths stated below.

(d) It must stand bending cold 180° to a diameter of the thickness of pieces tested without fracture on outside of bent portion.

In the case of round bars the elongation should not be less than 22 per cent. measured on a gauge-length of eight diameters. In the case of bars over one inch in diameter the elongation may be measured on a gauge-length of four diameters, and should then be not less than 27 per cent. For other sectional material the tensile and elongation tests should be those prescribed in the British Standard Specification for Structural Steel.

Before use in the work the metal must be clean and free from scale or loose rust. It should not be oiled or painted, but a wash of thick Portland cement grout is desirable.

Welding should in general be forbidden; if it is found necessary, it should be at points where the metal is least stressed, and it should never be allowed without the special sanction of the architect or engineer responsible for the design.

The reinforcement ought to be placed and kept exactly in the positions marked on the drawings, and, apart from any consideration of fire resistance, ought not to be nearer the surface of the concrete at any point than 1 in. in beams and ½ in. in floor slabs or other thin structures.

9. In all cases the concrete should be mixed in small batches and in accurate proportions, and should be laid as rapidly as possible.

When the materials are mixed by hand they are to be turned over and thoroughly mixed on a clean platform until the color of the cement is uniformly distributed over the aggregate.

Whenever practicable the concrete should be mixed by machinery.

10. The thickness of loose concrete that is to be punned should not exceed 3 in. before punning, especially in the vicinity of the reinforcing metal. Special care is to be taken to ensure perfect contact between the concrete and the reinforcement, and the punning to be continued till the concrete is thoroughly consolidated. Each section of concreting should be as far as possible completed in one operation; when this is impracticable, and work has to be recommenced on a recently laid surface, it is necessary to wet the surface; and where it has hardened it must be hacked off, swept clean, and covered with cement grout. Work should not be carried on when the temperature is below 34° Fahr. The concrete when laid should be protected from the action of frost, and shielded against too rapid drying from exposure to the sun's rays or winds, and kept well wetted. All shaking and jarring must be avoided. The efficiency of the structure depends chiefly on the care with which the laying is done.

The amount of water to be added depends on the temperature at the time of mixing, the materials, and the state of these, and other factors, and no recommendation has therefore been made. Sea-water should not be used.

11. The centering must be of such dimensions, and so constructed, as to remain rigid and unyielding during the laying and punning of the concrete. It must be so arranged as to permit of easing and removal without jarring the concrete. Provision should be made wherever practicable for splaying or rounding the angles of the concrete. Timber when used for centering may be advantageously limewashed before the concrete is deposited.

12. The time during which the centers should remain up depends on various circumstances, such as the dimensions or thickness of the parts of the work, the amount of water used in mixing, the state of the weather during laying and setting, etc., and must be left to the judgment of the person responsible for the work. The casing for columns, for the sides of beams, and for the soffits of floor slabs not more than 4 ft. span must not be removed under eight days; soffits of beams and of floors of greater span should remain up for at least fourteen days, and for large span arches for at least twenty-eight days. The centering of floors in buildings which are not loaded for some time after the removal of same may be removed in a short time; the centering for structures which are to be used as soon as completed must remain in place much longer. If frost occurs during setting, the time should be increased by the duration of the frost.

13. Before the detailed designs for an important work are prepared, and during the execution of such a work, test pieces of concrete should be made from the cement, sand and aggregate to be used in the work, mixed in the proportions specified. These pieces should be either cubes of not less than 4 in. each way, or cylinders not less than 4 in. diameter, and of a length not less than the diameter. They should be prepared in moulds, and punned as described for the work. Not less than four cubes or cylinders should be used for each test, which should be made twenty-eight days after moulding. The pieces should be tested by compression, the load being slowly and uniformly applied. The average of the results should be taken as the strength of the concrete for the purposes of calculation, and in the case of concrete made in proportions of 1 cement, 2 sand, 4 hard stone, the strength should not be less than 2,400 lb. per square inch.

Loading tests on the structure itself should not be made until at least two months have elapsed since the laying of the concrete. The test load should not exceed one and a half times the accidental load. Consideration must also be given to the action of the adjoining parts of the structure in cases of partial loading. In no case should any test load be allowed which would cause the stress in any part of the reinforcement to exceed two-thirds of that at which the steel reaches its elastic limit.

Methods of Calculation.—1. In designing any structure there must be taken into account:—

(a) The weight of the structure

(b) Any other permanent load, such as flooring, plaster, etc.

(c) The accidental load. By "accidental" load is meant the imposed load additional to the weight of the structure for which the structure is calculated.

(d) In some cases also an allowance for vibration and shock.

Of all probable distributions of the load, that is to be assumed in calculation which will cause the greatest straining action.

The weight of the concrete and steel structure may be taken at 150 lb. per cubic foot.

In structures subjected to very varying loads and more or less vibration and shock, as, for instance, the floors of public halls, factories, or workshops, the allowance for shock may be taken equal to half the accidental load. In structures subjected to considerable vibration and shock, such as floors carrying machinery, the roofs of vaults under passage ways and courtyards, the allowance for shock may be taken equal to the accidental load.

In the case of columns or piers in buildings, which support three or more floors, the load at different levels may be estimated in this way. For the part of the roof or top floor supported, the full accidental load assumed for the floor and roof is to be taken. For the next floor below the top floor 10 per cent less than the accidental load assumed for that floor. For the next floor 20 per cent less, and so on to the floor at which the reduction amounts to 50 per cent of the assumed load on the floor. For all lower floors the accidental load on the columns may be taken at 50 per cent of the loads assumed in calculating those floors.

2. Spans may be taken as follows: For beams the distance from center to center of bearings. For slabs supported at the ends, the clear span + the thickness of slab. For slabs continuous over more than one span the distance from center to center of beams.

3. In the most ordinary case of a uniformly distributed load of w lbs. per inch run of span the bending moments will be as follows:

(a) Beam or slab simply supported at the ends. Greatest bending moment at center of span of l inches is equal to $w\ l^2/8$ inch-lbs.

(b) Beam continuous over several spans, or encastré or fixed in direction at each end. The greatest bending moments are at the ends of the span, and the beam should be reinforced at its upper side near the ends. If continuity can be perfectly relied on, the bending moment at the center of the span is $w\ l^2/24$, and that over the supports — $w\ l^2/12$. If the continuity is in any way imperfect, the bending moment at the center will in general be greater, and that at the supports less, but the case is a very indefinite one. It appears desirable that generally in building construction the center bending moment should not be taken less than $w\ l^2/12$. The bending moment at the ends depends greatly on the fixedness of the ends in level and direction. When continuity and fixing of the ends, whether perfect or imperfect, is allowed for in determining the bending moment near the middle of the span, the beam or slab must be designed and reinforced to resist the corresponding bending moments at the ends. When the load is not uniformly distributed the bending moments must be calculated on the ordinary statical principles.

4. The internal stresses are determined as in the case of a homogeneous beam, on these approximate assumptions:

(a) The coefficient of elasticity in compression of stone or gravel concrete, not weaker than 1:2:4, is treated as constant and taken at one-fifteenth of the coefficient of elasticity of steel: Coefficient for concrete $= Ec =$ 2,000,000 lb. per square inch; coefficient for steel $= Es =$ 30,000,000 lb.; $Es \div Ec = 15$. It follows that at any given distance from the neutral axis, the stress per square inch on steel will be fifteen times as great as on concrete.

(b) The resistance of concrete to tension is neglected, and the steel reinforcement is assumed to carry all the tension.

(c) The stress on the steel reinforcement is taken as uniform on a cross-section, and that on the concrete as uniformly varying.

5. If the concrete is of such a quality that its crushing strength is 2,400 to 3,000 lb. per square inch after twenty-eight days, and the steel has a tenacity of not less than 60,000 lb. per square inch, the following stresses may be allowed:

Concrete, in compression in beams subjected to bending, 600 lb. per square inch; concrete in columns under simple compression, 500 lb. per square inch; concrete in shear in beams, 60 lb. per square inch; adhesion of concrete to metal, 100 lb. per square inch; steel in tension, 15,000 to 17,000 lb. per square inch.

It is desirable that the reinforcing rods should be so designed that the adhesion is sufficient to resist the shear between the metal and concrete. Precautions should in every case be taken by splitting or bending the rod ends, or otherwise to provide additional security against the sliding of the rods in the concrete.

When the proportions of the concrete differ from those stated above the stress in compression allowed in beams may be taken at one-fourth, and that in columns at one-fifth of the crushing stress of cubes of the concrete of sufficient size at twenty-eight days after gauging. If stronger steel is used than that stated above, the allowable tensile stress may be taken at one-half the stress at the yield point of the steel.

Let b be the width and d the effective depth of the beam in inches.

$A = bd$ the area of cross-section.

$m = E_s\ E_c$ the ratio of the coefficients of elasticity of steel and concrete.

$M =$ bending moment at the section considered, in inch-pound units.

$t =$ tensile stress in metal in pounds per square inch.

$c =$ compressive stress in concrete per square inch.

$z =$ distance of resultant thrust in concrete from compressed edge of beam in inches.

$kd =$ distance of neutral axis from compressed edge in inches.

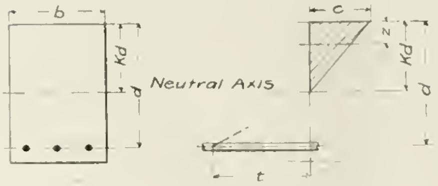
$A_c = kbd =$ area of concrete in compression in square inches.

$A_t =$ area of metal in tension in square inches.

$p = A_t\ bd$ the ratio of section of metal to section of concrete.

$l =$ span in inches.

$w =$ load per inch of span.



Beam With Rectangular Section.

(a) Beams of Rectangular Section with Single Reinforcement.—In a homogeneous beam the stresses are proportional to the distances from the neutral axis. In a discrete beam, such as a beam of concrete and steel, on account of the greater rigidity of steel, at a given distance from the neutral axis the stress in the steel will be m times as great as in concrete. Hence—

$$\frac{mc}{t} = \frac{kd}{d\ (1-k)} = \frac{k}{1-k}$$

But equating the total tension and compression

$$\tfrac{1}{2}\ cbkd = pbdt$$
$$ck = 2pt.$$

Replacing c in terms of t

$$k^2 \div m\ (1-k) = 2p$$
$$k = \sqrt{\ }\ (p^2m^2 + 2pm) - pm.$$

Thus for $m = 15$.

$p = 0.007,\ 0.010,\ 0.015,\ 0.020.$

$k = 0.365,\ 0.417,\ 0.483,\ 0.530.$

That is, the neutral axis is lower as the amount of reinforcement is greater, and passes the half depth for 2 per cent of reinforcement.

The distance of the resultant thrust from the compressed edge is $z = \frac{1}{3}kd$.

Equating the moments of resistance to the bending moment,

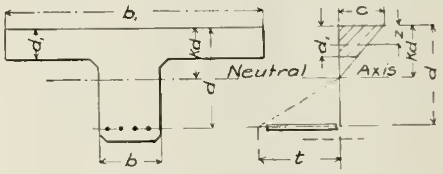
$$M = A_t t\ (d - \tfrac{1}{3}kd) = \tfrac{1}{2}A_c c\ (d = \tfrac{1}{3}kd)$$

$$t = \frac{M}{A_t d\ (1 - \frac{1}{3}k)} = \frac{M}{pbd^2\ (1 - \frac{1}{3}k)}$$

$$c = \frac{2M}{A_c d\ (1 - \frac{1}{3}k)} = \frac{2M}{kbd^2\ (1 - \frac{1}{3}k)}$$

The shearing stresses and tensions near the ends of the beam are usually resisted by stirrups or inclined steel bars, and it is always desirable to bend upwards near the supports one or more of the reinforcing bars when the reduced bending moments at the ends permit of so doing. Stirrups or rigidly attached web members or inclined bars should be provided in all cases where the average shearing stress on a vertical section of the beam exceeds 60 lb. per square inch of the section. A theoretical determination of the section required for these would be very difficult. If the simple case is taken of a uniformly loaded beam, supported at the ends with horizontal steel tension bars not bent up at the ends, the adhesion between concrete and steel which is required may be found thus: The difference of tension in 1-ft. length of bars at the end of the span will be the tangential force between steel and concrete in that distance. The bending moment at the end is 0, and at 1 ft. from the end $6w\ (l-12)$ inch-pounds, where w is the load per inch run. Hence the increment of tension between the end and 1 ft. from the end is

$$6w\ (l-12) \div d\ (1 - \tfrac{1}{3}\ k)\ \text{lb.}$$



Beams With T Section.

If Σ is the total perimeter of the reinforcing bars, the adhesion stress is $w(l-12) \div \Sigma\ d\ (1 - \frac{1}{3}k)$ lb. per square inch.

(b) Beams of T Section with Single Reinforcement.—In designing T beams where

the upper flange forms a floor the thickness d_1 of this will first be ascertained by considering the part between two ribs as a slab, having its own reinforcing bars transverse to the rib. The whole of this cannot in general be considered to form part of the upper flanges of the T beams. The width b_1 of the upper flange may be assumed to be not greater than one-third the span of the beams, or than three-fourths of the distance from center to center of the reinforced ribs. There is no satisfactory theoretical determination of the precise amount of the floor slab acting with the web. The depth d should then be determined with reference to the stiffness required in the floor. In general d is from one-twelfth to one-eighteenth of the span.

Two cases arise according as the thickness of flange is greater or less than kd, the distance from the neutral axis to the compressed edge. In the former case (d_1 greater than kd) the rules under (a) apply if b is substituted for b, and $A = b^2 d_1 + b (d - d_1)$ for bd. The equations then become

$$mc \div t = k \div (1 - k)$$

$$k = \sqrt{\left(\frac{2pAm}{b_1 d} + \frac{p^2A^2m^2}{b_1^2d^2}\right)} - \frac{pAm}{b_1 d}$$

$$= \sqrt{\left(\frac{2Atm}{b_1 d} + \frac{At^2m^2}{b_1^2d^2}\right)} - \frac{Atm}{b_1 d}$$

$$z = \tfrac{1}{3}kd$$

$$t = \frac{M}{A_t d\,(1 - \frac{1}{3}k)} = \frac{M}{pAd\,(1 - \frac{1}{3}k)}$$

$$c = \frac{2M}{A_c d\,(1 - \frac{1}{3}k)} = \frac{2M}{kb_1 d\,(1 - \frac{1}{3}k)}$$

where $pA = A_t$, the section of reinforcement. The increment of tension in 1 ft. length at the end of the beam and the adhesion stress is the same as in (a).

When d_1 is less than kd the small compression in the web between d_1 and kd may be neglected.

Let, as before, the whole area of section $= Ab_1d_1 + b\ (d - d_1)$, and pA be the area of reinforcement.

$$mc \div t = k \div (1 - k).$$

The mean compressive stress on the flange is

$$\tfrac{1}{2}\left\{c + c\,\frac{kd - d_1}{kd}\right\} = \frac{c}{2}\,\frac{2kd - d_1}{kd}.$$

Equating the total tension and compression,

$$A_t t = pAt = \tfrac{1}{2}b_1d_1c\,(2kd - d_1) \div kd$$

$$kd = \frac{b_1d_1^2 + 2pAmd}{2b_1d_1 + 2pAm} = \frac{b_1d_1^2 + 2A_tmd}{2b_1d_1 + 2A_tm}$$

$$\text{But } z = \frac{d_1}{3}\,\frac{3kd - 2d_1}{2kd - d_1}$$

Equating the moments

$$M = A_t t\,(d - z) = pAt\,(d - z) = \tfrac{1}{2}b_1d_1c\,(2kd - d_1)\,(d - z) \div kd$$

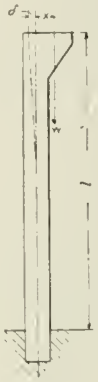
It may be useful also to point out that the area of reinforcement for a given value of c/t is

$$A = pA = \frac{c}{t}\,\frac{b_1d_1\,(2kd - d_1)}{2kd}$$

(c) *Slabs Supported on More Than Two Sides.*—It does not appear that there is either a satisfactory theory or trustworthy experiments from which the strength of rectangular slabs supported or fixed on all four edges can be determined.

(a) *Short Columns Axially Loaded.*—The reinforcement of columns should in general amount to at least 0.8 per cent of the gross cross-section. The liability to bending of the longitudinal reinforcing bars greatly weakens the column, and should be prevented by steel binding bars. Some theoretical considerations would indicate that cross-binding is required at points not further apart than twenty-four times the least lateral dimensions of the reinforcing rods. But further experiment shows that still closer cross-binding, or, better, spiral binding, greatly increases the strength of the column.

(M. Considère recommends that the distance between the coils of the spiral should not exceed from 1/10 to 1/7 of the diameter of the spiral. In the case of piles subjected to longitudinal shock in driving there are special reasons for decreasing the distance between the cross-binding near the ends.)



Column Eccentrically Loaded.

If the load is strictly axial the stress is uniform on cross-sections. Let A_c be the cross-section of the column (including the reinforcement), and A the equivalent section as defined below, a the section of longitudinal reinforcing bars, P the load of the column in pounds. Let c be the stress on the concrete, and t that on the steel, the ratio of the coefficients of elasticity being m.

$$c = \frac{P}{A_c + (m - 1)a} = \frac{P}{A}$$

$$t = \frac{mP}{A_c + (m - 1)a} = \frac{mP}{A}$$

It appears that c may be taken $= 500$ lb. per square inch, $t = 7{,}500$ lb. per square inch, and $E_s \div E_c = m = 15$.

When the stress on the concrete is not greater than 500 lb. per square inch, lateral bending of the column as a whole is not to be feared if the ratio of length to the least lateral dimension is not greater than 18.

(b) *Columns Eccentrically Loaded.*—If a column initially straight is loaded eccentrically, as when a beam rests on a bracket attached to the column, it may be regarded as fixed at the base and free at the loaded end. Then it must bend in the plane passing through the load, the deflection at the top being δ. Let x be the eccentricity of the load measured from the center of the column when straight. Then the bending moment at the base of the column is $W(\delta + x)$. But it is known that δ will be small compared with x, provided that W is small compared with $2EI/l^2$, and this will be the case in such conditions as are likely to occur in designing concrete columns. Then the bending moment may be taken as Wx, and the stress at the base of the column, treating it as homogeneous, will be

$$f = W\left\{\frac{1}{A} \pm \frac{x}{Z}\right\}$$

very nearly, where A is the whole section of the column and Z the modulus of the section relatively to an axis through the center of gravity and at right angles to the plane of bending.

In dealing with reinforced columns which are not homogeneous, it is convenient to substitute for the actual section of the column what may be termed the equivalent section, or section of concrete equivalent in resistance to the actual column. If Ac is the area of section of the column (including the area of reinforcement) and a is the area of reinforcement, then the equivalent section is

$$A = A_c + (m - 1)a.$$

If h is the depth of the section in the plane of bending, the moment of inertia relatively to the neutral axis can be expressed in the form $I = nAh^2$, and the section modulus in the form $Z = 2nAh$.

It is desirable in columns that there should be no tension, and generally when the vertical load is considerable there is none. Cases in which the eccentricity is so great that there is tension must be treated by the methods applicable to beams if it is made a condition that the steel carries all the tension. In the following cases it is assumed that there is no tension.

Case I.—Column of Circular Section, Reinforcements Symmetrical and Equidistant from the Neutral Axis. Let m be the ratio $E_s \div E_c$ of the coefficients of elacticity of steel and concrete, Ac the cross section of the column in square inches, a the area of reinforcement in square inches, h the diameter of the column, ht the distance between the reinforcing bars perpendicular to the neutral axis. Then the equivalent section is

$$A = A_c + (m - 1)a$$

and the modulus of the section is

$$Z = \tfrac{1}{8}A_ch + \tfrac{1}{8}\,(m - 1)a\,h_t^2 \div h.$$

The stress at the edges of the section can then be calculated by the general equation

$$f = W\left\{\frac{1}{A} \pm \frac{x}{Z}\right\}$$

where x is the eccentricity of the load in inches and W the load in pounds. The greater value of f must not exceed the safe stress stated above.

Case II.—Rectangular Section with Reinforcement Symmetrical and Equidistant from the Neutral Axis. Using the same notation as in the last case, h being now the depth of the section in the plane of bending, the section modulus is

$$Z = \tfrac{1}{6} A_c h + \tfrac{1}{2} (m - 1) a\, h_t^2 \div h$$

and the stresses are given by the same equation as in the previous case.

Case III.—Column of Circular Section with Reinforcing Bars arranged in a Circle.—Using the same notation as in Case I, h_t being the diameter of the circle of reinforcing bars, the section modulus is

$$Z = \tfrac{1}{8} A\, h + \tfrac{1}{4} (m - 1) a\, h_t^2 \div h,$$

and the stresses are given by the same equation as in Case I.

(c) Long Columns Axially Loaded.—For columns more than 18 diameters in length there is risk of lateral buckling of the column as a whole. The strength of such columns would be best calculated by Gordon's formula, but there are no experiments on long columns by which to test the values of the constants for a concrete or concrete and steel column. There does not seem, however, to be any probability of serious error if the total load is reduced in a proportion inferred from Gordon's formula to allow for the risk of buckling.

Let, as before, A_c = the section of the column in inches; a = the reinforcement. Then $A = A_c + (m - 1)a$ is the equivalent section. Let n be the constant in the equation, $I = nAh^2$, and h the least transverse dimension of the column.

Then for a column fixed in direction at both ends, Gordon's formula is

$$W/Af = 1 \div (1 + l^2/cnh^2) = 1 \div (1 + K)$$

so that the column will carry less than a short column of the same dimensions in the ratio of $1 + K$ to 1, or in other words, the column will be safe if calculated as a short column, not for the actual load, W, but for a load $(1 + K)\ W$.

The constant c has not been determined experimentally for reinforced long columns. But its probable value is $c = 4\pi^2 E_c/f$, where f is the ultimate crushing stress. Putting $E_c = 2{,}000{,}000$ and $f = 2{,}500$, then $c = 32{,}000$. Looking at the well-understood uncertainty of the rules for long columns, very exact calculation is useless.

VALUES OF $1 + K$ FOR THREE VALUES OF n.

	Case. I.	Case II.	Case III.
l/h	$n = 0.098$	$n = 0.075$	$n = 0.0646$
20	1.13	1.17	1.19
25	1.20	1.26	1.30
30	1 20	1.38	1.44

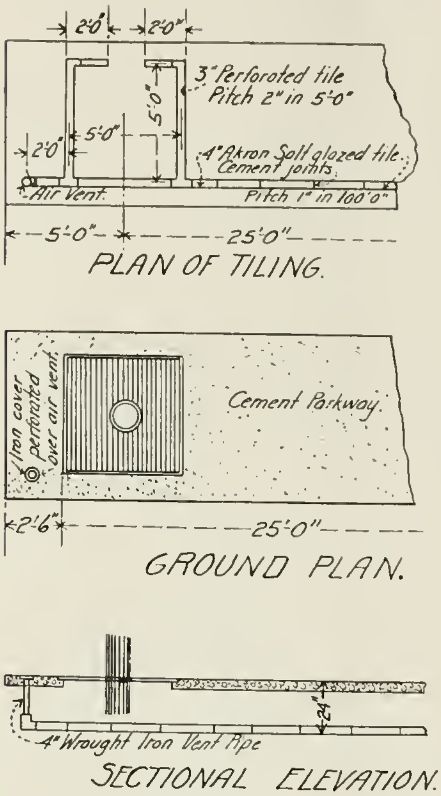
The differences of $1 + K$ for considerable differences of n are not very great.

In the case of columns fixed at one end and rounded or unfixed at the other, $2K$ must be substituted for K. If the column is rounded at both ends, $4K$ must be substituted for K.

A syndicate of New York and Canadian Capitalists is planning to build 2,000 miles of new railroad in Brazil.

Tree Watering System for Parkway.

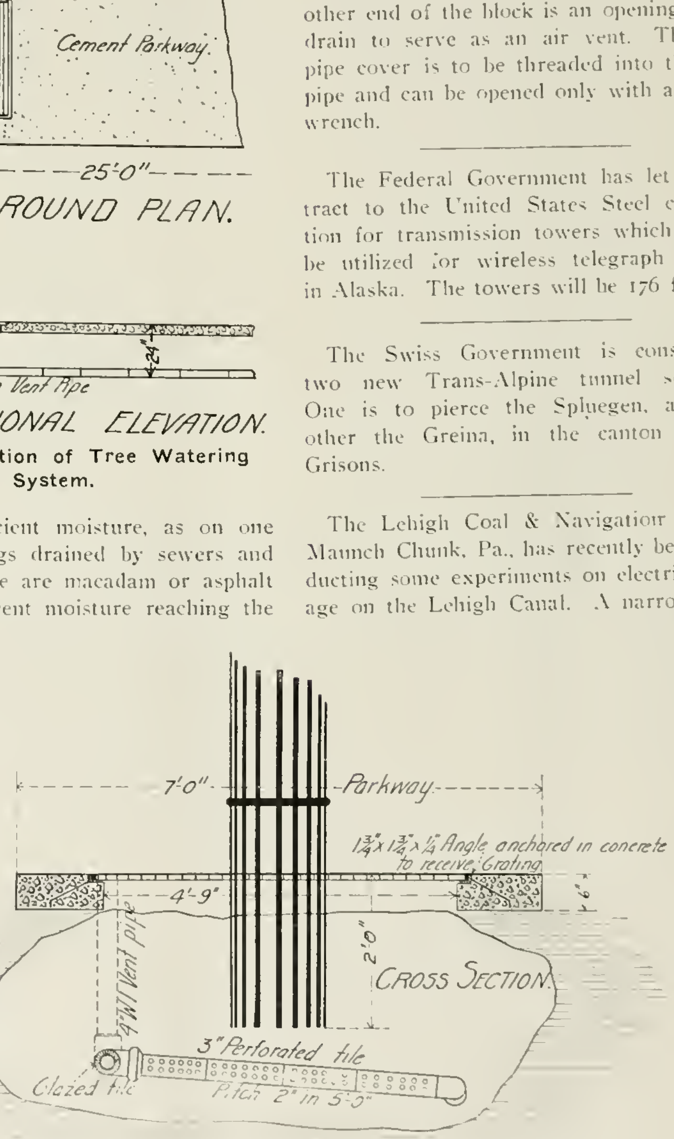
Considerable trouble has been experienced in maintaining trees in the parkways on Jackson and Washington Boulevards in the business district of Chicago. This is principally due to the fact that the trees cannot get sufficient moisture, as on one side are buildings drained by sewers and on the other side are macadam or asphalt streets that prevent moisture reaching the subsoil and the roots of the trees. Then too, the smoke laden atmosphere has much to do with preventing the healthy growth of the trees.



Details of Section of Tree Watering System.

To offset these effects as much as possible, a system of subirrigation is to be installed for the parkways on Jackson Boulevard by Mr. Jens Jensen, general superintendent of the West Chicago Park Commission. By this system it will be possible to give the trees sufficient water and liquid fertilizer in the most economical way in a space that will be covered with concrete, except the immediate space surrounding the trees. The latter is to be protected by an iron grating so as to permit the transplanting of trees if they should die, and also to permit the air to penetrate the soil. The accompanying cuts show some of the details of the proposed system.

The trees are to be spaced 25 ft. apart and each is to be surrounded by a tree guard. The water and liquid fertilizer is to be fed into the drain through an iron feed pipe at one end of the block; at the other end of the block is an opening in the drain to serve as an air vent. The feed pipe cover is to be threaded into the feed pipe and can be opened only with a special wrench.



Cross-Section Showing Underground Watering System.

The Federal Government has let a contract to the United States Steel corporation for transmission towers which are to be utilized for wireless telegraph service in Alaska. The towers will be 176 ft. high.

The Swiss Government is considering two new Trans-Alpine tunnel schemes. One is to pierce the Spluegen, and the other the Greina, in the canton of the Grisons.

The Lehigh Coal & Navigation Co., of Mauch Chunk, Pa., has recently been conducting some experiments on electric haulage on the Lehigh Canal. A narrow gage track has been constructed along the canal for a distance of three miles, and a 10-ton electrically propelled truck running on this track was used in towing the canal boat. The experiments are said to have been a success.

Engineers' Pocketbook of Reinforced Concrete.*

BY E. LEE HEIDENREICH, C. E., M. E.

(Continued from Engineering-Contracting, July 24, 1907.)

Foundations.— From tests, the bearing power of the soil is found to be 5,000 lbs. per sq. ft. As we cannot encroach upon the adjacent property, rafts must be resorted to on the north and east sides. Rafts 2-7, 3-8 and 15-14 are calculated alike.

Raft 2-7.—The principle consists in constructing a base, the center of gravity of which coincides with the center of gravity of the two unequal loads.

The calculation becomes approximate as we move in the outside column one foot, on account of sheet piling, etc., and add 18 ins. at the other end of the raft beyond the centers calculated. See Fig. 2.

Load column 2 = 284,575 lbs.
Load column 7 = 386,600 lbs.

Sum .... = 671,175 lbs.
Dividing by 5,000 = 134.23 sq. ft.

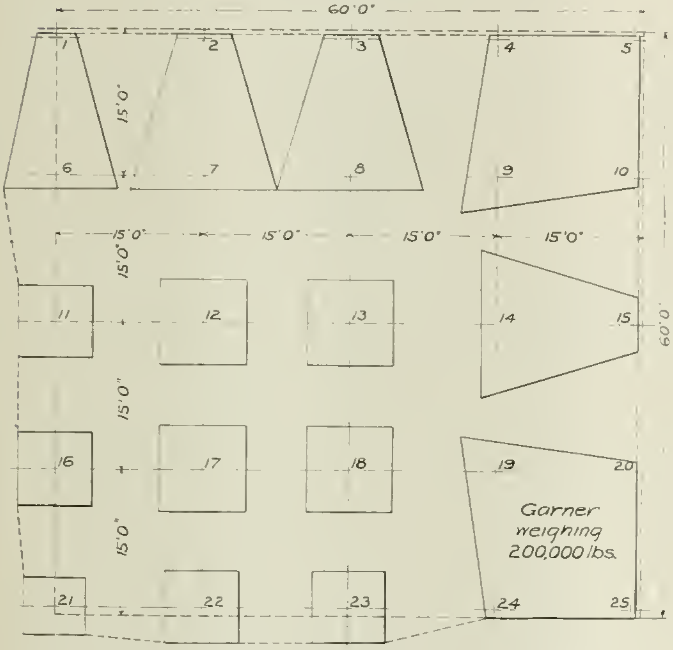


Fig. 1, Foundation Plan Showing Position of Rafts.

$$\text{Area of raft} = \frac{b_1 + b_2}{2} \times 14 = 134.23.$$

$$b_1 + b_2 = 19.18.$$

$$l_1 = \frac{284575}{671175} \times 14 = 5.94.$$

$$l_1 = \frac{14}{3}\,\frac{b_1 + 2b_2}{b_1 + b_2} = \frac{14}{3}\,\frac{b_1 + 2b_2}{19.18} = 5.94$$

Solving, $b_2 = 5.22$, and $b_1 = 13.95$.

To find the cross-section of raft, we must find the center of gravity of one-half the trapezoid, which gives the leverage for the bending moment, as follows:

$$b_1 - b_2 = 13.95 - 5.22 = 8.73.$$

$$\frac{b_3 - b_2}{8.73} = \frac{l_2}{14} = \frac{8.06}{14}.$$

$$b_3 - b_2 = 5.03.$$

$$b_3 = 5.03 + 5.22 = 10.25.$$

$$l_3 = \frac{l_2}{3}\,\frac{b_3 + 2b_2}{b_3 + b_2} = \frac{8.06}{3} \times \frac{10.25 + 2 \times 5.22}{10.25 + 5.22} = 3.59.$$

In like manner, solving for l_5,

$$l_5 = 3.12.$$

Let A = area of entire trapezoid, and a = the area of that part to the left of the center of gravity, CG, then

$$M = Wl_2 - \frac{a}{A}(W + W_1)l_3 = W_1\,l_1 - \frac{A - a}{A}\,(W + W_1)\,l_5 =$$
2,294,800 — 1,120,750 = 1,174,050 ft. lbs.*

This is 1,174,050 × 12 = 14,088,600 in. lbs. Per inch of width this is

$$\frac{14088600}{10.25 \times 12} = 114{,}540 \text{ in. lbs.}$$

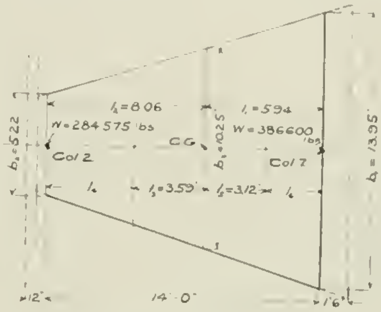


Fig. 2, Diagram for Raft 2-7.

If we choose n = 15, as E_c for concrete in a comparatively large mass is nearer 2,000,000, we get (page 68*)

$$M_s = pf\left(1 - \frac{k}{3}\right) bd^2.$$

$$\text{Choosing } p = 0.01 \text{ and } \left(1 - \frac{k}{3}\right) = .861,$$

$$M_s = 0.01 \times 16{,}000 \times 0.861 \times 1 \times d^2.$$

Whence d = 29 ins.

Adding 2 ins., we get h = 31 ins., for the slab, and the steel area is 0.01 × 29 = 0.29 sq. ins. per inch. 0.29 × 12 = 3.48 sq. ins. per ft., or according to table of circles, 1¼-inch rods, 4⅜ ins. on centers.

For compression, by combining formulas 5 and 6,

$$\tfrac{1}{2}Ck = pf, \text{ or } C = \frac{pf}{\frac{1}{2}k} = \frac{0.01 \times 16000}{\frac{1}{2} \times 0.417}$$

C = 767 lbs. per sq. in., which is safe.

If however, we specify a maximum safe load in compression of 500 lbs., we find the reinforcement as follows:

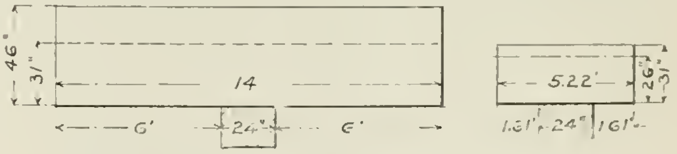


Fig. 3, Diagram for Foot of Columns 7 and 2.

$$767 - 500 = 267 \text{ lbs. excess.}$$

$$267 \times \frac{kd}{2} = 267 \times \frac{0.417 \times 29}{2} = 1617 \text{ lbs.}$$

$\frac{1617}{16000}$ = 0.1 sq. ins. reinforcement required for each one-inch in width, or approximately 1-in. rods every 8 inches.

The distributing rods under column 7 are approximated as follows‡, see Fig. 3:

$$M = \frac{386600}{2} \times \frac{6}{2} \times 12 = 7000000 \text{ in. lbs.}$$

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*These figures are obtained by using greater accuracy in the measurements, than the 2 places of decimals here given

†Reprinted elsewhere in this article.

‡To gain practice in using take p. 79 (reprinted July 24) we here use n = 10 and p = .0083, instead of 15 and 0.01 respectively.

Assuming a width of 36 ins., each inch would have a moment of

$$M = \frac{7000000}{36} = 194000 \text{ inch lbs.}$$

By table p. 79, this gives a depth of 46 ins., with a steel area 0.36 sq. ins. for each inch width.

$36 \times 0.36 = 12.96$ sq. ins., which by table p. 58 gives 12 rods, 1 3-16 ins. in diameter (laid in two courses).

Similarly for column 2,

$$M = \frac{284575}{2} \times \frac{1.61}{2} \times 12 = 1{,}370{,}000 \text{ in lbs}$$

For a width of 24 ins., this gives per inch,

$$\frac{1370000}{24} = 57000 \text{ in. lbs.}$$

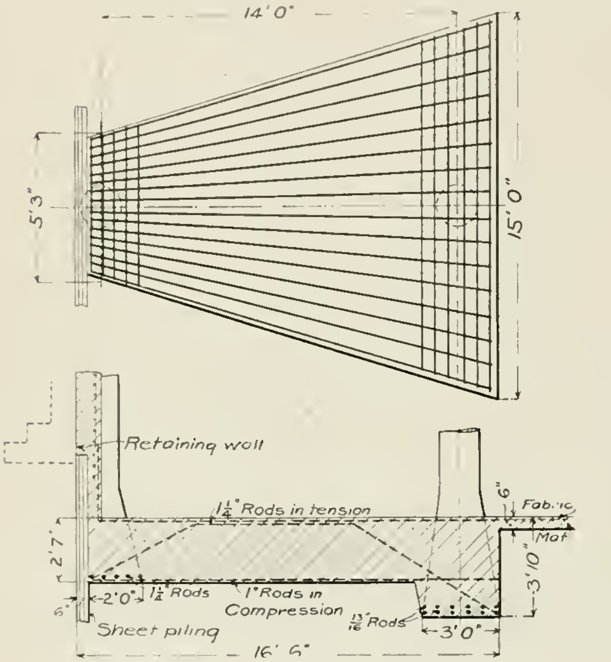


Fig. 4, Plans and Section of Raft 2-7.

This corresponds to a depth of 26 ins. and a steel area of 0.199 sq. ins., or 1¼-in. rods 6 ins. on centers. However, this depth will be taken at 31 ins., the same as the slab.

The raft 2-7 will therefore be shown as in Fig. 4, the decimals being replaced by feet and inches.

Rafts 3-8 and 15-14 are like raft 2-7, and raft 1-6 is calculated in a similar manner.

Quadrilateral Raft 4-5-9-10.—See Fig. 5. The outside columns are each moved in one foot.

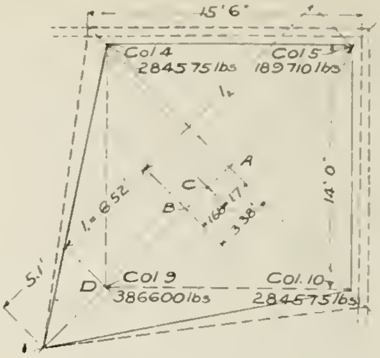


Fig. 5, Diagram for Raft 4-5-9-10.

4 = 284,575 lbs.
5 = 189,710 lbs.
9 = 386,600 lbs.
10 = 284,575 lbs.

1,145,460 lbs.
1,145,460 ÷ 5,000 = 229.1 sq. ft.

The center of gravity between 4 and 10 is at the center of a line connecting them, at point A, which represents

2 × 284,575 = 569,150 lbs.
5 = 189,710
9 = 386,600

B = 576,310

$l_1 = \frac{189710}{576310} \times 14 \times 1.414 = 6.52$, which makes the distance between A and B, 3.38 ft.

$$\text{From B to C} = \frac{569150}{1145460} \times 3.38 = 1.68 \text{ ft.}$$

3.38 — 1.68 = 1.7, which locates the center of gravity, C, of the entire raft.

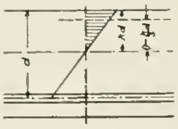
Enough area is added along AD so that the center of gravity of the quadrilateral may be at c. This additional distance DE is 3 × 1.7 = 5.1 ft.

$$\text{The added area is } 5.1 \times \frac{14}{2} \times 1.414 = 50 \text{ sq. ft.}$$

Area square 4-5-9-10 is 14 × 14 = 196 sq. ft. 196 + 50 = 246 sq. ft., which is over 229 sq. ft. and therefore safe.

(Reprinted from page 68 of forthcoming book. Engineers' Pocket-book of Reinforced Concrete.)

Assumptions for New York (See sketch):—



$C = 500$ lbs. per sq. in.
$s = 50$ lbs per sq. in.
$f = 16{,}000$ lbs. per sq. in.

$$p = \frac{\text{Area of steel}}{bd}$$

$$k = \sqrt{2np + n^2p^2} - np \qquad (4)$$

$$M = \tfrac{1}{2}Ck\left(1 - \frac{k}{3}\right)bd^2 \qquad (5)$$

$$M_s = pf\left(1 - \frac{k}{3}\right)bd^2 \qquad (6)$$

$$V = s\left(1 - \frac{k}{3}\right)bd \qquad (7)$$

$$K_c = \tfrac{1}{2}Ck\left(1 - \frac{k}{3}\right) \qquad (8)$$

$$K_s = pf\left(1 - \frac{k}{3}\right) \qquad (9)$$

The following table gives values of K for various proportions of steel used in designing concrete beams, slabs, etc.

	n=12.					n=15.				
p.	k.	$1-\frac{k}{3}$	Kc.	Ks.	K.	k.	$1-\frac{k}{3}$	Kc.	Ks.	K.
.001	.143	.952	35.8	15.2	15.2	.158	.947	37.6	15.2	15.2
.002	.196	.935	45.8	29.9	29.9	.215	.928	50.0	29.6	29.6
.003	.235	.922	54.2	44.3	44.3	.258	.914	58.9	43.8	43.8
.004	.266	.911	60.2	58.4	58.4	.291	.903	65.8	57.8	57.8
.005	.291	.903	65.8	72.2	65.8	.319	.894	71.2	71 4	71.2
.006	.314	.896	70.3	86.0	70.3	.343	.885	76.2	84.8	76.2
.007	.334	.889	74.2	99.5	74 2	.366	.878	80.3	98.6	80.3
.008	.352	.883	77.7	113.0	77.7	.384	.872	83.8	111 7	83.8
.009	.370	.877	81.1	126.1	81.1	.401	.866	86.9	124 7	86.9
.010	.384	.872	83.8	139.8	83.8	.417	.861	90.0	137.8	90.0
.011	.398	.867	86.4	152.5	86.4	.432	.856	92 4	150.6	92.4
.012	.411	.863	88.8	166	88.8	.444	.852	94.8	163.8	94 8
.014	.435	.855	93.0	192.	93.0	.470	.843	99.1	188.5	99 1
.016	.456	.848	96.7	217.	96.7	.492	.836	103.0	214.0	103 0
.018	.476	.841	100.0	243.	100.	.513	.829	106.0	238.3	106.0
.020	.493	.836	103.	267.	103.	.530	.823	108.8	263.2	108 8
.030	.561	.813	114.	390.	114	.600	.800	120 0	384	120 0
.040	.610	.796	122.	510.	122.	.650	.784	127.6	502.	127 6
.050	.650	.783	127.	628.	127.	.680	.774	131.8	620.	128.2

The same method as was employed for raft 2-7 will give the section and reinforcement for raft 4-5-9-10. The raft, as constructed, will measure 15 ft. 6 ins. on the north and east sides, as shown in Fig. 5.

Square Footings, 12, 13, 17 and 18.—See Fig. 6. Since the area required is 77.3 sq. ft., the side is

$$\sqrt{77.3} = 8 \text{ ft. } 9 \text{ in.} \times 8 \text{ ft. } 9 \text{ in.}$$

With a column 20 ins. in diameter, its area is 2.17 sq. ins. The load is 386,600 lbs.

$$2.17 \times 5{,}000 = 10{,}850 \text{ lbs.}$$

$$386{,}600 - 10{,}850 = 375{,}750 \text{ lbs.}$$

$$M = \frac{375750}{8} \times \frac{8\frac{3}{4}}{4} \times 12 = 1232930 \text{ inch lbs.}$$

or per inch.

$$\frac{1232930}{12} = 102750,$$

Width of imaginary beam in inches, is

$$\frac{8.75 \times 12}{3} = 35 \text{ ins.}$$

$$\frac{102750}{35} = 2935 \text{ in. lbs. per inch of width.}$$

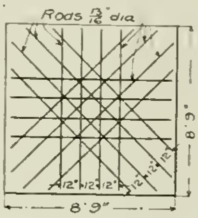


Fig. 6, Plan of Footings 12, 13, 17, and 18, Showing Reinforcement.

By table p. 79, interpolating between 2,600 and 3,740, we find steel area approximately 0.045, or for 12 ins. centers,

$$0.045 \times 12 = 0.54 \text{ sq. ins.}$$

This corresponds to a diameter of 13-16 in. It takes 4 rods 13-16 in. in diameter crossing each other at right angles, and 4 rods 13-16 in. in diameter on each diagonal.

Similar calculations will give figures for the other square footings.

The above calculations are, of course, approximate, but they are safe, and are as simple as any calculations the author has seen.

The mat reinforcement consists of a 6x6 in. mesh high carbon steel fabric of No. 7 and No. 9 gauge wire, laid within 2 ins. of the top of the 6-in. floor, depressed under the columns to about 5 ins. below the floor.

Before excavation a Wakefield sheet piling should be carefully driven along the north and east building lines, the basement columns being here moved in 12 ins. The retaining walls run from column to column, and above the sheet piling are built out to the building line. The fabric continues from the mat up within 2 ins. of the inside of the retaining wall, and to it is wired such reinforcing rods as are required to withstand the earth pressure from the adjacent property.

The first story columns are placed on the building line, by cantilevering the girders 12 ins. It will be found that the steel above calculated will take care of this cantilever action, but the author always adds two more rods at the bottom of the girder, bent at 1/3 the span and reaching the top at each end.

The curtain walls are reinforced with fabric only and are 6 ins. thick.

Where the building ordinances permit it, the author uses a high carbon wire fabric, deducting the strength of same from the required steel area; for instance, in calculating 1st to 6th floors, we had, steel area = 0.288 sq. ins. per foot. For 4x6-in. No. 7 gauge we have

$$3 \times 0.0254 = 0.0762.$$

Safe strength, 28,000 lbs. makes it equal to twice the area at 14,000 lbs., or 0.1524 sq. in. Hence the steel area required is

$$0.2880 - 0.1524 = 0.1356$$

Using ½-in. rods as before,

$$\frac{0.196}{0.1356} \times 12 = 17\frac{1}{4} \text{ ins. on centers,}$$

instead of 8⅛ ins., and if, owing to the increased lateral continuity, we use

$$M = \frac{wl^2}{14} \text{ or } \frac{wl^2}{16},$$

still lighter steel areas will be found, and have been successfully used in carefully executed work.

(To be continued.)

Catalogs Worth Having.

No. 0291. **Traction Engines.**—The Huber Manufacturing Co., Marion, Ohio.

The increasing use of traction engines to take the place of animal power is well illustrated by this catalog. The engravings given show traction engines being used for hauling practically all kinds of contractors' machinery; for plowing; tearing up macadam streets; and for general haulage purposes. Detail drawings are shown of the various parts of the engine, and there is also a considerable amount of descriptive text accompanying them.

No. 0292. **Asphaltoilene.**—Good Roads Improvement Co., Cincinnati, O.

This pamphlet has been issued for the purpose of exploiting oiled roads. The Asphaltoilene used on these roads is described as the equivalent of pure asphalt dissolved in petrolene, only a sufficient amount of petrolene being used to make it fluid and act as a vehicle. After the Asphaltoilene is applied to the road the petrolene is absorbed, leaving a surface of asphalt. The pamphlet describes the method of construction and shows a number of illustrations of Asphaltoilene roads.

No. 0293. **Mining Hoists.**—Sullivan Machinery Co., Chicago, Ill.

This pamphlet illustrates and describes the line of mining hoists made by the firm named above for especially deep mine work. Like all the catalogs issued by this firm it is very complete in descriptive matter and gives a really excellent idea of the various machines included.

No. 0294. **Engineers' Instruments.**—Herman Pfister, Cincinnati, O.

This is a catalog and price list of engineers' transits, levels, and other surveying instruments made by the firm named. Each of the several instruments is described in considerable detail and prices are given of the complete instrument and its several parts.

No. 0295. **Door Hangers.**—The Richards Manufacturing Co., Aurora, Ill.

This is a catalog and price list of the large line of door hangers manufactured by the firm named. There is a large number of different forms of hangers included and each is described and has its price given. The catalog also contains a list of hardware specialties.

No. 0296. **Gas Engines.**—Challenge Co., Batavia, Ill.

The Challenge Gas Engine operates upon the four-cycle principle. The engines illustrated in this catalog are designed particularly for pumping work. Each is described in detail with illustrations of the several parts. The catalog concludes with some practical suggestions for the installation and operation of gas engines for pumping work.

No. 0297. **Contractors' Locomotives.**—Davenport Locomotive Works, Davenport, Iowa.

This pamphlet is a brief discussion of the features which are necessary for economical and efficient operation in a contractor's locomotive. The firm issuing it began manufacturing contractors' locomotives five years ago, and has made a specialty of this machine for contractors' work. Besides describing the general features of locomitive construction, the catalog gives a list of contractors who are using Davenport locomotives.

No. 0298. **Contractors' Tents.**—United States Tent and Awning Co., Chicago, Ill.

The firm issuing this catalog manufactures a general line of awnings and tents for various purposes. The line of contractors' tents, both house tents and stable tents, is very complete. Brief descriptions are given of the various styles, together with tables of sizes, quality of material, prices, etc.

No. 0299. **Hoisting Engines.**—Monighan's Machine Works, Chicago, Ill.

This is a handsomely printed catalog describing and illustrating a full line of hoisting engines and hoists for building work. The firm has recently enlarged its factory and is now in position to meet the demands of its customers for the various lines of improved hoisting machinery handled by it.

No. 0300. **Gas Engines.**—De La Vergne Machine Co., New York, N. Y.

This is a well illustrated, well written, descriptive catalog of the Koerting four-cycle gas engine handled by the firm named. The Koerting engine has been extensively used in Germany and is described in this catalog in its improved form. Detail drawings are given of the several working parts and the descriptive matter is unusually clear and instructive.

No. 0301. **Dump Wagons.**—Marion Dump Wagon Co., Marion, Ohio.

This circular describes the construction and operation of the Marion dump wagon. The particular feature of this wagon is that the doors open crosswise of the wagon box. This, it is claimed, enables the load to be dumped without stalling the wagon and also permits the gear to be closer coupled than is possible with most styles of dump wagons constructed.

No. 0302. **Industrial and Portable Railways.**—Arthur Koppel Co., Pittsburg, Pa.

This pamphlet illustrates and gives the main dimensions and capacities of Koppel cars for industrial railway purposes. The cars described include practically all the patterns manufactured by the company.

No. 0303. **Leadite.**—The Leadite Company of America, Philadelphia, Pa.

Leadite, as most of our readers know, is a substitute which is offered by the company named above for lead for calking water mains. This pamphlet contains a paper read before the second annual meeting of the American Public Works Association, describing the composition of this new pipe jointing material and explaining the method of applying it in actual construction.

No. 0304. **Gasoline Engine.**—The "New-Way" Motor Co., Lansing, Mich.

This catalog describes the "New-Way" air cooled gasoline engine which has been worked out by the firm named with the particular idea of applying it to the operation of concrete mixers. The engine is described and illustrated in detail and there are a number of illustrations showing its application to concrete mixers. The pamphlet also contains a number of testimonial letters from contractors who have used it for mixing concrete.

Personals.

Mr. E. J. Cook, architect, has opened an office at Fairmont, Minn.

Mr. Bruno J. Feldman, 64 W. 144th street, New York, has been appointed an assistant engineer, board of water supply of New York City.

North American Dredging Co., engineers and general contractors, has removed its main office from Bacon building, Oakland, Cal., to 715 Merchants Exchange building, San Francisco, Cal.

Prof. William F. M. Goss has resigned as dean of the school of engineering at Purdue University to accept the position of dean of the engineering college of the University of Illinois.

Mr. George P. Carver has opened an office in the Exchange building, 53 State street, Boston, Mass., where he will engage in consulting work, making a specialty of reinforced concrete construction.

Mr. T. R. Atkinson, heretofore assistant state engineer of North Dakota, has been appointed state engineer to succeed Mr. A. L. Fellows, who resigned to engage in consulting practice in Denver, Colo.

Mr. Josiah Gibson has accepted a position as chief draftsman with the Southwestern Bridge Co., Joplin, Mo. He was formerly in charge of railway bridge detailing with the Wisconsin Bridge & Iron Co.

Mr. A. A. Lane, for some years past Engineer with the Taylor-Wilson Manufacturing Co., of Pittsburg, Pa., has been engaged to fill the position of office manager in the Reinforced Concrete Department of the General Fireproofing Co. at Youngstown, O.

Mr. Curtis Hill, for a number of years Civil Engineer of the Sewer Department of St. Louis, Mo., has resigned that position and has been appointed State Highway Engineer for the State of Missouri. Mr. Hill's headquarters will be at Columbia, Mo

Mr. George M. Wisner, heretofore assistant engineer of the sanitary district of Chicago, Ill., has been appointed chief engineer to succeed Mr. Isham Randolph, whose resignation of that position recently went into effect. Mr. Randolph will engage in private practice.

Brigadier General Charles Francis Powell, retired, died July 30, at the home of his brother in St. Paul, Minn., aged 63 years. General Powell, who was in the Engineer Corps, retired from active service in March, 1906. He was a native of South Carolina and was graduated from West Point in 1867.

Mr. Chas. Iffer, for the past five years connected with the General Supply & Construction Co. of New York City, as manager, has formed a company bearing the firm name of Chas. Iffer & Co., and has opened offices at 1161 Broadway, New York. The company will engage in general contracting in reinforced concrete and heavy construction.

The Engineers' and Contractors' club, a new engineering society, has been organized in Philadelphia, the membership being limited to the engineers composing the organization of Dodge & Day. The officers of the club are: President, Harold T. Moore; secretary, George Walters; managers, F. C. Andrews, H. F. Sanville, John E. Zimmermann, C. N. Lauer.

The Board of Water Supply of New York City opened bids Aug. 6 for the construction of the main dams for Ashokan reservoir, the work being done in connection with the construction of the Catskill aqueduct for furnishing a new supply for New York. The work in connection with the construction of the main dam includes 2,055,000 cu. yds. earth excavation, 425,000 cu. yds. rock excavation and 7,055,000 cu. yds. refilling and embankment. About 280,000 cu. yds. of concrete masonry, 530,000 cu. yds. cyclopean masonry and 64,000 cu. yds. concrete blocks are also included. About 1,100,000 bbls. Portland cement will be required.

CONTRACT NEWS

We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Bids Open.		See Issue.
Aug. 7.	Chicago, Ill.	July 31
Aug. 7.	Decatur, Ind.	July 31
Aug. 7.	Anderson, Ind.	July 31
Aug. 7.	Alva, Okla.	July 31
Aug. 7.	Galena, Ill.	July 31
Aug. 7.	Indianapolis, Ind.	July 31
Aug. 7.	Warsaw, Ind.	July 24
Aug. 7.	Peru, Ind.	July 24
Aug. 8.	New Albany, Ind.	July 24
Aug. 8.	Zanesville, O.	July 24
Aug. 8.	Grand Rapids, Mich.	Aug. 7
Aug. 9.	Hamburg, Pa.	July 31
Aug. 10.	Cleveland, O.	July 17
Aug. 10.	Washington, D. C.	July 31
Aug. 12.	Los Angeles, Cal.	July 31
Aug. 12.	Mangum, Okla.	July 31
Aug. 12.	Mitchell, S. Dak.	July 31
Aug. 12.	New Ulm, Minn.	Aug. 7
Aug. 12.	Fort Worth, Tex.	Aug. 7
Aug. 15.	Mount Gilead, O.	July 24
Aug. 15.	Jackson, O.	July 24
Aug. 16.	Cincinnati, O.	July 24
Aug. 13.	Napa, Cal.	Aug. 7
Aug. 16.	Denver, Colo.	Aug. 7
Aug. 16.	Spokane, Wash.	July 31
Aug. 19.	Jefferson, O.	July 31
Aug. 19.	Council Bluffs, Ia.	Aug. 7
Aug. 20.	San Juan, P. R.	July 24
Aug. 20.	Des Moines, Ia.	Aug. 7
Aug. 23.	Sandusky, O.	Aug. 7
Aug. 23.	Pittsburg, Pa.	Aug. 7
Aug. 24.	Lebanon, O.	Aug. 7
Sept. 2.	Tarboro, N. C.	July 31
Sept. 4.	Glasgow, Mont.	July 31
Sept. 30.	Santiago, Chile	July 17

Buildings

Aug. 7.	Halifax, N. S.	July 17
Aug. 7.	Baltimore, Md.	July 24
Aug. 7.	Upper Sandusky, O.	July 31
Aug. 8.	Brooklyn, N. Y.	July 31
Aug. 9.	Spring City, Pa.	July 31
Aug. 9.	Lakewood, O.	July 24
Aug. 9.	Lakewood, O.	July 17
Aug. 9.	Monticello, Ind.	July 3
Aug. 10.	Brenham, Tex.	July 31
Aug. 10.	West Point, N. Y.	Aug. 7
Aug. 12.	West Allis, Wis.	July 31
Aug. 12.	Grand Junction, Colo.	July 31
Aug. 12.	Mason City, Ia.	July 3
Aug. 12.	New York, N. Y.	Aug. 7
Aug. 12.	New York, N. Y.	Aug. 7
Aug. 12.	Brooklyn, N. Y.	Aug. 7
Aug. 12.	Guttenberg, N. J.	Aug. 7
Aug. 12.	Woodward, Ia.	Aug. 7
Aug. 12.	Cleveland, O.	Aug. 7
Aug. 12.	Chapman, Kan.	Aug. 7
Aug. 13.	Montclair, N. J.	Aug. 7
Aug. 13.	Boston, Mass.	Aug. 7
Aug. 14.	New York, N. Y.	Aug. 7
Aug. 14.	Springfield Township, O.	July 24
Aug. 14.	Washington, D. C.	July 31
Aug. 14.	Ionia, Mich.	July 31
Aug. 15.	Boston, Mass.	Aug. 7
Aug. 15.	Thompson, Ia.	Aug. 7
Aug. 15.	Fort Myer, Va.	Aug. 7
Aug. 15.	Walter, Okla.	Aug. 7
Aug. 15.	Fort Leavenworth, Kan.	Aug. 7
Aug. 15.	Humboldt, Ia.	Aug. 7
Aug. 15.	New York, N. Y.	July 31
Aug. 15.	Philadelphia, Pa.	July 31
Aug. 15.	Stonington, Conn.	July 31
Aug. 15.	Albany, N. Y.	July 24
Aug. 15.	North Chicago, Ill.	July 24
Aug. 15.	Bakersville, N. C.	July 17
Aug. 15	Terre Haute, Ind.	July 24
Aug. 17	Lafayette, Ind.	Aug. 7
Aug 17	Peru, Ind.	July 24
Aug 19	Alexandria, Minn.	July 17
Aug. 20	Decatur, Ill.	July 17
Aug. 20.	Spearfish, S Dak.	July 24
Aug 20	Montevallo, Ala.	July 24
Aug 20	Athens, O.	July 31
Aug. 20	Lumberton, N C	July 31
Aug. 2[illegible]	Fort Dodge, Ia.	July 31
Aug 22.	Jackson, Miss.	July 24
Aug. 22.	Jackson, Mich	July 17
Aug. 22	Orient, O.	Aug 7
Aug. 23.	Washington, D C	Aug. 7
Aug. 23.	Delaware, O.	July 31
Aug. 24.	Geneva, Ill.	July 17
Aug. 26	Milwaukee, Wis.	Aug. 7
Aug. 27	Springfield Township, O.	Aug 7
Aug. 27	Trenton, N. J.	July 31
Aug. 29	Wahpeton, N. Dak.	Aug. 7
Aug 29.	Iowa City, Ia.	Aug 7
Sept 3.	Watertown, N. Y.	July 31
Sept. 3.	Bloomfield, Ind.	July 31
Sept. 3.	Washington, D C	Aug 7
Sept. 3.	Bloomfield, Ind.	Aug. 7
Sept. 4	Quincy, Mass.	July 31
Sept. 5.	Evansville, Ind	Aug. 7
Sept. 16.	Pittsburg, Pa	Aug. 7
Sept. 16.	Buffalo, N. Y.	Aug 7

Roads and Streets.

Aug 7.	Rockville, Ind.	July 24
Aug. 7.	Peru, Ind.	July 24
Aug. 7.	Des Moines, Ia.	July 24
Aug. 7	Toledo, O.	July 31
Aug. 8.	Columbus, O.	Aug 7
Aug. 8.	Milwaukee, Wis.	Aug. 7
Aug. 8.	Cleveland, O.	July 31
Aug. 8	Brooklyn, N. Y.	July 31
Aug. 8.	Hookset, N. H.	July 31
Aug. 8.	Riverton, N. J.	July 31
Aug. 8.	Concord, N. H.	July 31
Aug. 8.	Brooklyn, N. Y.	July 31
Aug. 8.	New York, N. Y.	July 31
Aug. 8.	St Paul, Minn.	July 31
Aug. 8.	Brooklyn, N. Y.	July 31
Aug. 8	Hartford City, Ind	July 31
Aug. 9.	Richmond, Ind.	Aug. 7
Aug. 9.	Milwaukee, Wis.	Aug. 7
Aug. 9.	Toledo, O.	Aug 7
Aug. 9.	Indianapolis, Ind.	Aug 7
Aug. 9.	Bluffton, Ind.	Aug 7
Aug 9.	Des Moines, Ia.	July 31
Aug. 9.	Valparaiso, Ind.	July 31
Aug. 9.	Monessen, Pa.	July 24
Aug. 10.	Bellevue, O.	July 31
Aug. 10.	Covington, Ind.	July 31
Aug 10.	Hardin, Ill.	July 31
Aug. 10.	Scottville, Mich.	July 31
Aug 10.	Struthers, O.	July 24
Aug. 10.	Lisbon, O.	July 24
Aug. 10.	Findlay, O.	July 24
Aug. 10.	Celina, O.	July 24
Aug 10.	Ilion, N. Y.	Aug. 7
Aug. 10	Denver, Colo	Aug. 7
Aug. 10.	Springfield Township, O.	Aug. 7
Aug. 12	Cedar Rapids, Ia.	July 31
Aug 12.	Cincinnati, O.	July 31
Aug. 12	Steubenville, O.	Aug 7
Aug. 12	Syracuse, N. Y.	Aug 7
Aug. 12	Pittsburg, Pa	Aug. 7
Aug. 12.	New Ulm, Minn	Aug. 7
Aug. 12.	Muskegon, Mich	Aug. 7
Aug 12.	Youngstown, O	Aug. 7
Aug. 12.	Struthers, O.	Aug. 7
Aug. 13	South Bend, Ind.	Aug 7
Aug. 13.	Milwaukee, Wis.	Aug. 7
Aug 13.	Florse, Mich	Aug. 7
Aug 13.	Huntington, Ind.	July 24
Aug. 14.	Brooklyn, N. Y	Aug 7
Aug 14.	New York, N Y.	Aug. 7
Aug 14	New York, N. Y.	Aug. 7
Aug. 14.	Baltimore, Md.	Aug. 7
Aug. 14.	Marshall, Tex.	Aug. 7
Aug 14.	Toledo, O.	Aug 7
Aug. 14.	Fort Riley, Kan	Aug 7
Aug. 15	Kansas City, Mo	Aug. 7
Aug 15	Saginaw, Mich.	Aug 7
Aug 15	Elizabeth, N. J.	July 31
Aug. 16	Olympia, Wash	Aug 7
Aug. 16	Cincinnati, O	Aug 7
Aug. 17	Ottawa, O	Aug. 7
Aug 17	Huntsville, Ala	July 31
Aug. 17	Cleveland, O	July 24
Aug. 19.	Tipton, Ind	Aug. 7
Aug. 19.	Steubenville, O	Aug 7
Aug. 19.	Westfield, N J	Aug 7
Aug 20.	Cleveland Heights, O	July 24
Aug 20.	Cleveland Heights, O	July 24
Aug 21	Aberdeen, Wash	Aug. 7
Aug. 21	Fort St. Philip, [illegible]	Aug 7
Aug 24	[illegible]	July 31
Aug 26.	Pittsburg, Pa	Aug 7
Aug. 27.	[illegible], Pa.	July 31
Aug 28	Hoboken, N J	Aug. 7
Aug. 28	Hoboken, N J	July 31
Aug. 28	Fort Lee, N J	Aug. 7
Aug. 30.	Cincinnati, O	Aug 7
Aug 30	Marshfield, M	July 31
Sept 3.	New Philadelphia, O	Aug. 7
Sept 3	Yorktown, Va	Aug 7

Sewers.

Aug 7	Chicago, Ill	July 31
Aug. 7	Denver, Colo	July 31
Aug. 7.	Steelton, Pa	July 17
Aug. 7.	Oelwein, Ia	Aug 7
Aug. 8.	Milford, Mass	Aug. 7
Aug. 8	Belvidere, Ill	Aug. 7
Aug. 8.	Kansas City, Mo	Aug 7
Aug. 8.	Fort Oglethorpe, Ga	July 17
Aug. 8.	Bloomfield, Ind.	July 17
Aug. 8.	St. Paul, Minn	July 31
Aug. 8.	Green Bay, Wis	July 31
Aug. 9.	Milwaukee, Wis	Aug. 7
Aug. 9.	Richmond, Ind	Aug. 7
Aug. 9.	Sandusky, O	Aug. 7
Aug. 9.	Minot, N. Dak.	Aug. 7
Aug. 9.	Indianapolis, Ind.	Aug. 7
Aug. 12.	Pittsburg, Pa.	Aug. 7
Aug. 12.	East Liverpool, O	Aug 7
Aug. 12.	New York, N Y	Aug. 7
Aug. 12.	Omaha, Neb	Aug. 7
Aug. 12.	Pekin, Ill.	Aug 7
Aug. 12.	Weehawken, N J	Aug 7
Aug. 12.	New Castle, Pa.	Aug. 7
Aug. 12.	Youngstown, O.	Aug. 7
Aug. 12.	New Ulm, Minn.	Aug 7
Aug. 12.	Madison, S Dak	July 31
Aug. 12.	Willmar, Minn.	July 24
Aug 12.	Marshfield, Wis	July 24
Aug. 13.	Lincoln, Cal.	July 31
Aug. 13.	Cleveland, O.	Aug 7
Aug. 13.	Milwaukee, Wis	Aug. 7
Aug. 13.	Gas City, Ind.	Aug. 7
Aug. 13.	South Bend, Ind	Aug 7
Aug. 14.	Brooklyn, N Y	Aug. 7
Aug. 14.	Oakland, Cal	July 31
Aug. 14.	Boise, Idaho	July 31
Aug. 15.	St Paul, Minn	Aug. 7
Aug. 15.	Cleveland, O	Aug 7
Aug. 15.	Staples, Minn	Aug 7
Aug 15.	Arkadelphia, Ark	July 31
Aug 15.	Elizabeth, N J	July 31
Aug. 15.	Camden, Ark.	July 24
Aug. 17	Asbury Park, N J	Aug 7
Aug. 19	Webster Groves, Mo	Aug 7
Aug. 19	Riverside, N J.	Aug 7
Aug. 19	Port Clinton, O	July 24
Aug. 19.	Cape Girardeau, Mo	July 31
Aug. 20.	[illegible]	July 31
Aug 20.	Cleveland Heights, O	July 24
Aug. 21.	North Chicago, Ill	July 31
Aug 22	Fayetteville, Ark	[illegible]
Aug. 23.	Delaware, O	July 31
Aug. 30	Evansville, Ind	July 24
Sept. 6	[illegible]	[illegible]
Sept. 11.	New Orleans, La	[illegible]

Water Supply.

Aug 7	Chicago, Ill.	[illegible]
Aug 8.	New York, N Y	July 31
Aug 8	[illegible], S D	July 31
Aug. 9.	Fort [illegible], N J	July 17
Aug. 12.	Belle Plaine, Minn	July 24
Aug 12	Cleveland, O	Aug. 7
Aug 12	New Ulm, Minn	Aug 7
Aug. 13	Columbus, O	July 17

Aug. 19. Sacramento, Cal. ....June 5
Aug. 19. Lombard, Ill..............July 31
Aug. 20. Dawson, Minn. . ...Aug. 7
Aug. 20. Russellville, Ark.........July 24
Aug. 21. Springfield, Mass.........July 31
Aug. 21. Fort Hancock, N. J.....July 31
Aug. 22. Philadelphia, Pa..........July 31
Aug. 26. Ashland, O. ....Aug. 27
Aug. 27. Cincinnati, O..............July 31
Sept. 2. Carrington, N. Dak.......Aug. 7
Sept. 4. New Orleans, La. ....July 3

Miscellaneous.

Aug. 7. Brooklyn, N. Y., Crib Bulkhead, July 31
Aug. 8, Cleveland, O., Power House Superstructure, July 31
Aug. 8. Fort Omaha, Neb., Gas House, Etc., July 24
Aug. 8. St. Joseph, Mo., Pile Work, Aug. 7
Aug. 9, Hadley, Mass., Riprap, July 31
Aug. 10, Hickory, N. C., Dam, Power Plant, Etc., July 31
Aug. 10. Chicago, Ill., Concrete Work, Aug. 7
Aug. 12. Pittsburg, Pa., Concrete Wall, Aug. 7
Aug. 12. New York, N. Y., Coal Vault, Aug. 7
Aug. 12. Jersey City, N. J., Garbage Removal, Aug. 7
Aug. 12. Union, N. J., Garbage Removal, Aug. 7
Aug. 12. Louisville, Ky., Retaining Wall, Aug. 7
Aug. 12. Cleveland, O., Brick Chimney, Aug. 7
Aug. 12. Indianapolis, Ind., Fire Cistern, Aug. 7
Aug. 10, Santa Barbara, Cal., Bulkhead, July 31
Aug. 12, New York, N. Y., Tunnel, July 31
Aug. 12. Brownsville, Pa. Lock, Walls, Etc., July 17
Aug. 13. New York, N. Y., Freight Sheds, July 31
Aug. 13. Washington, D. C., Wrecking Buildings, Aug. 7
Aug. 14. Oakland, Cal., Street Sweeping, July 31
Aug. 14. Key West, Fla., Breakwater, July 31
Aug. 14. Baltimore, Md., Pier Work, Aug. 7
Aug. 15. New York, N. Y., Pier Work, Aug. 7
Aug. 15. Boston, Mass., Subway Entrance, July 31
Aug. 16. Galveston, Tex., Jetty Work, July 24
Aug. 19. Washington, D. C., Steam Vessel, July 24
Aug. 20. San Diego, Cal., Wharf and Trestle, June 26
Aug. 20. Fort Ontario, N. Y., Fence, Aug. 7
Aug. 22. New York, N. Y., Electric System, Aug. 7
Aug. 24. Bremerton, Wash., Concrete Quay Wall, July 24
Aug. 24. Toledo, O., Monument, July 31
Aug. 26. Jacksonville, Fla., Jetty Work, Aug. 7
Aug 27. Cincinnati, O., Tracks, Grading, Etc., July 31
Aug. 30. Philadelphia, Pa., Suction Dredges, Aug. 7
Aug 31. Galveston, Tex., Jetty Work, Aug. 7
Aug. 31. Lebanon, Pa., Street Lighting, July 24
Sept. 1, Webb City, Mo., Railroad, July 31
Sept 3. Winnipeg, Man., Hydro-Electric Development, June 19
Sept. 30. Washington, D. C., Search Light Outfit, Aug. 7
Oct 5. Franklin Shoals, Ark., Lock and Dam, Aug. 7

Excavation, Earth and Rock.

Aug. 7. Mason City, Ia., Tile Drains, July 31
Aug. 7. San Juan, P. R., Dredging, July 3
Aug. 10. Portsmouth, N. H., Filling, July 24
Aug. 10. Aztec, N. Mex., Irrigation Canal, July 31
Aug. 10. Hawkins, Tex., Levee Work, Aug. 7
Aug. 12. Philadelphia, Pa., Dredging, July 24
Aug. 12. Washington, D. C., Dredging, July 24
Aug. 12 Norwalk, Conn. Dredging, July 17
Aug. 15. Cheboygan, Mich., Dredging, July 24
Aug. 15. Mason City, Ia., Drain, Aug. 7
Aug. 16. Brooklyn, N. Y., Filling, Aug. 7
Aug. 16. New York, N. Y., Filling, Aug. 7
Aug. 16. Tampa, Fla., Dredging, July 24
Aug. 19. New London, Conn., Dredging, July 31
Aug. 20. Charleston, S. C., Dredging, Aug. 7
Aug. 20. Weymouth, Mass., Dredging, Aug. 7
Aug. 22. Brunswick, Ga., Dredging, July 24
Aug. 23. Savannah, Ga., Dredging, July 31
Aug. 26, Fort Washington, Md., Grading, Draining, July 31
Aug. 26. New York, N. Y., Embankment, July 31
Aug. 26. Block Island, R. I., Dredging, Aug. 7
Aug. 30. Portland, Me., Rock Excavation, Aug. 7
Sept. 2. Tacoma, Wash., Dredging, Aug. 7
Sept. 4. Providence, R. I., Dredging, Aug. 7
Sept. 10, Sibley, Ia., Ditch Work, July 31

Materials, Machines, Supplies, Tools Etc

Aug. 7. New York, N. Y., Motor Generator Sets, Etc., July 31
Aug. 8, Cleveland, O., Boiler, Superheater, Etc., July 31
Aug. 8, Cleveland, O., Meter Manhole Rings, July 31
Aug. 8. Cleveland, O., Water Meters, Aug. 7
Aug. 8. Washington, D. C., Rails, Ties, Piles, Etc., July 24
Aug. 9, Washington, D. C., Pipe, Valves, Etc., July 31
Aug. 10, Huntsville, Ala., Sewer Pipe, Brick, July 31
Aug. 10. Portsmouth, N. H. Elevator, July 17
Aug. 12. Washington, D. C., Steel Dump Barges, July 31
Aug. 12. New York, N. Y., Vacuum Sweeping Plant, Aug. 7
Aug. 12. Saint Bernard, O., Air Compressor, Aug. 7
Aug. 13. Halifax, N. S., Meters, Aug. 7
Aug. 13. New York, N. Y., Pipe, Electrical Supplies, Etc., July 31
Aug. 13. Portsmouth, N. H., Barrows, Shovels, Pike, Etc. July 31
Aug. 13. Boston, Mass., Boring Machines, Etc., July 31
Aug. 13, New Orleans, La., Tile Drain Pipe, July 31
Aug. 13, Pensacola, Fla., Timber, Brick, Cement, Etc., July 31
Aug. 13, Washington, D. C., Navigator's Supplies, Drills, Etc., July 31
Aug. 13. Trenton, N. J., Vacuum Cleaning Plant, Aug. 7
Aug. 14, Washington, D. C., Track Scales, Tanks, Etc., July 31
Aug. 14, Washington, D. C., Elevators, July 31
Aug. 14. Wheeling, W. Va., Iron and Steel, July 24
Aug. 14. West Hoboken, N. J., Street Signs, Aug. 7
Aug. 15. New York, N. Y., Lumber, Aug. 7
Aug. 16. Chicago, Ill., Machinery, July 24
Aug. 19. West Point, N. Y., Lamp Posts, Lanterns, Aug. 7
Aug. 20, Mare Island, Cal., Brick, Timber, Etc., July 31
Aug. 21, Tompkinsville, N. Y., Moorings, July 31
Aug. 22. Tompkinsville, N. Y., Lantern, Aug. 7
Aug. 22. Washington, D. C., Engine, Tank, Etc., Aug. 7
Aug. 23. Newark, N. J., Electric Equipment, Aug. 7
Aug. 26. Detroit, Mich., Fir Timber, Aug. 7
Aug. 29. San Francisco, Cal., Motors, Chain Drives, Etc., Aug. 7
Sept. 3. Kansas City, Mo., Pipe and Specials, Aug. 7
Sept. 3. Kansas City, Mo., Steel Pipe, Aug. 7
Sept, 8, Louisville, Ky., Pumping Engines, July 31
Sept. 14. Manila, P. I., Valves, Gates, July 31

BIDS ASKED.

Bridges,

Items Arranged Alphabetically by States.

Napa, Cal.—Bids are asked by County Supervisors, N. W. Collins, Clerk, until Aug. 13, for building a stone bridge across a small creek on the county road leading from Calistoga to Lake County.

Denver, Colo.—Competitive plans and specifications will be received at the office of T. W. Jaycox, State Engineer, until noon, Aug. 16, for a bridge over the Arkansas at Portland, Colo. The design must conform to the following general specifications and a statement to that effect must be placed on the plans. The price of the plans must also be stated thereon. The designer whose plans are accepted will be paid this price. The material to be reinforced concrete or steel. The length of bridge to be 125 ft., one or two spans, 16 ft. width roadway.

Denver, Colo.—Bids are asked by T. W. Jaycox, State Engineer, until noon, Aug. 16, for complete construction of a 350 ft. pile bridge over Big Sandy Creek at Kit Carson.

Council Bluffs, Ia.—Bids are asked by W. F. Sapp, City Clerk, until Aug. 19, for furnishing all material and constructing two reinforced concrete bridges, one at Frank Creek and one at 8th St.

Des Moines, Ia.—Bids are asked by Board of Public Works, City Hall, until 11 a. m., Aug. 20, for the complete construction of five-span reinforced concrete highway bridge over and across the Des Moines River at its intersection with Locust St. in Des Moines. Certified check for $10,000 required with bid.

Grand Rapids, Mich.—Bids are asked by C. Huizenga, Highway Commissioner, Wyoming Township, Court House, Grand Rapids, until 2 p. m., Aug. 8, for the construction of a steel bridge, concrete abutments, in the township of Wyoming, Kent County, Mich. Plans and specifications with C. Huizenga, Grandville, Mich.

New Ulm, Mich.—Bids are reported asked by City Clerk, until 5 p. m., Aug. 12, for the construction of a bridge over Cottonwood River, near the Bentzin Mill.

Lebanon, O.—Bids are asked by S. A. Stillwell, County Auditor, until Aug. 24, for labor and material for building bridge superstructure over Little Miami River at Mather's Mill; also concrete substructure for the bridge.

Sandusky, O.—Bids are asked by Commissioners of Erie County, Charles Kubach, County Auditor, until 1:30 p. m., Aug. 23, for labor and material for construction of substructure and superstructure of bridge over Mills Creek on Monroe St., Sandusky.

Pittsburg, Pa.—Bids are asked by F. P. Booth, County Controller, until noon, Aug. 23, for painting 85 bridges; riprapping abutment of bridge No. 18, Chartiers Creek; riprapping and underpinning bridge No. 1, Poketo Creek; reinforcing steel work, painting and reflooring bridge No. 1, Squaw Run; repairing floors of bridge No 1, Kelleys Run, and No. 15, Chartiers Creek; and reflooring bridges No. 1, Catfish Run; 12, Chartiers Creek; 1 Cunninghams Run; 6, Little Deer Creek; 2 Humms Run; 1, Millers Run; 2, Millers Run; Piersons Run; 1, Upper Branch of Plum Creek; 1, Poketo Creek; 1, Little Saw Mill Run; 2, Squaw Run; 1, Thompsons Creek, and 3, Thompsons Run, West Branch

Fort Worth, Tex.—Bids are asked by C. J. McKenna, County Auditor, until 9 a. m., Aug. 12, for steel bridge over Big Fossil Creek, in Tarrant County. Bridge to be 60 ft. span; 6 ft. concrete piers, concrete abutment piers with proper fills ready for gravel.

Buildings.

Items Arranged Alphabetically by States.

Washington, D. C.—Bids are asked by Major W. C. Langfitt, U. S. Engrs., until noon, Sept. 3, for construction of two double sets of non-commissioned officers' quarters at Washington Barracks, D. C.

Woshington, D. C.—Bids are asked by Major J. T. Crabbs, Constructing Quartermaster, Walter Reed Army General Hospital, Takoma Substation, Washington, until 11:30 a. m., Aug. 23, for the construction, including pumping, gas piping and electric lighting, of a double set of Hospital Corps servants' quarters at Walter Reed Army Hospital, Washington.

Humboldt, Ia.—Bids are asked by C. Messer, until 6 p. m., Aug. 15, for erection, with heating and plumbing, of library building at this place.

Iowa City, Ia.—Bids are asked by Wm. J. McChesney, Secretary, until 1 p. m., Aug. 29, for the erection of a president's residence, according to plans and specifications, which may be seen at the office of the superintendent of grounds and buildings at the university, and at the office of Proudfoot & Bird, Architects, 625 Flynn Bldg., Des Moines, Ia.

Thompson, Ia.—Bids are asked by J. H. Mortenson, Secretary, until 1 p. m., Aug. 15, for the erection of a school house in sub-district No. 4, Linden Township.

Bloomfield, Ind.—Bids are asked by Commissioners of Greene County, at Bloomfield, until 2 p. m., Sept. 3, for the construction of a jail cell house for the county.

Woodward, Ia.—Bids are asked by W. S Craft, Secretary, until noon, Aug. 12, for the erection of a 2-story brick opera house at Woodward. Plans at office of the secretary.

Evansville, Ind.—Bids are asked by Commissioners of Vanderburg County, Harry Stinson, County Auditor, until 10 a. m., Sept. 5, for erection of a stable and wash house for the county orphan asylum.

Lafayette, Ind.—Bids are asked by Commissioners of Miami County, at Lafayette, until noon, Aug. 17, for the construction of a cottage at the Lafayette Soldiers' Home.

Chapman, Kan.—Bids are asked by E. S. McCormick, County Superintendent of Public Instruction, Abilene, Kan., until Aug. 12, for construction of stone addition to Dickinson County High School at Chapman. L. M. Wood, Architect, 627 Kansas Ave., Topeka, Kan.

Fort Leavenworth, Kan.—Bids are asked by Capt. J. E. Normoyle, Constructing Q. M., until 11 a. m., Aug. 15, for electric wiring Sherman Hall and Annex thereto, at Fort Leavenworth, Kan.

Boston, Mass.—Bids are asked by George H. M. Rowe, Superintendent Boston City Hospital, Harrison Ave., until noon, Aug. 13, for building a pavilion to be known as the measles ward, on the grounds of the South Department of the Boston City Hospital, 745 Massachusetts Ave. William H. Besarick, Architect, 15 School St., Boston. Bond of $15,000 will be required.

Boston, Mass.—Bids are asked by Bath Department, 64 Pemberton Sq., until noon, Aug. 15, for plumbing bath house, North Bennet St., Boston, and giving bond of a surety company therefor in $2,000. Maginnis, Walsh & Sullivan, Architects, 100 Colonial Bldg., Boylston St.

Wahpeton, N. Dak.—Bids are asked by Commissioner of Indian Affairs, Washington, D. C., until 2 p. m., Aug. 29, for furnishing and delivering the necessary materials and labor required to construct and complete an employes' quarters with plumbing, steam heat and electric lighting, also a barn and a workshop both with plumbing and electric lighting, all of brick. For further information apply to James C. Clifford, Superintendent, Wahpeton.

Buffalo, N. Y.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Sept. 16, for the construction (except elevators) of the U. S. Marine Hospital, at Buffalo.

Guttenberg, N. J.—Bids are asked by Board of Education, James J. Moore, Clerk, 320 Herman Ave., until 8 p. m., Aug. 12, for alterations and building new addition to present school house on the southerly side of Franklin Ave., between 3rd and 4th Sts. Emil Guhl, Architect, 19 Charles St., Jersey City, N. J.

Montclair, N. J.—Bids are asked by Edward Russ, Chairman Building Committee of the New Jersey State Normal School at Montclair Heights, at the office of the Commissioner of Charities and Corrections, State House, Trenton, N. J., until 1 p. m, Aug. 13, for all the labor and materials necessary for the complete building and erection of a boiler house and the installation of a heating plant at the Normal School at Montclair Heights, N. J. Certified check for $2,500 required with bid.

Brooklyn, N. Y.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., until 3 p. m., Aug. 12, for the following work: Three contracts for completing and finishing heating and ventilating apparatus in public schools; installing electric equipment in the additional story of public school 80, west side of Seventeenth St., Borough of Brooklyn.

New York, N. Y.—Bids are asked by John F. Ahearn, Borough President, until 2 p. m., Aug. 14, for furnishing all the labor and material required for general alterations, decorations, etc., to provide additional space in the Criminal Courts building on the block bounded by Centre, White, Franklin and Lafayette Sts., in the Borough of Manhattan, City of New York. Security required is $10,000. Blank forms and specifications may be had at the office of the Commissioner of Public Works, 13 to 21 Park Row, Borough of Manhattan.

New York, N Y.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., until 8 p. m., Aug. 12, for the following work: Installing electric equipment in the new public school 66, on the north side of 86th St., about 175 ft. east of 1st Ave., Borough of Manhattan; security required is $5,000. Installing electric elevator in Stuyvesant high school, on 15th St., west of 1st Ave., Borough of Manhattan; security required is $1,500 Installing electric equipment in new public school 91, on northeast corner of Forsyth and Stanton Sts., Borough of Manhattan; security required is $6,000. Forming classrooms on first story of public school 169, on Audubon Ave., 168th and 169th Sts., Borough of Manhattan; security required is $1,000. Forming classrooms in first story and excavating for cellar at public school 171, at 103rd and 104th Sts., near 5th Ave., Borough of Manhattan; security required is $4,000. For alterations to electric system in Morris high school, 166th St., Boston Rd. and Jackson Ave., Borough of the Bronx; security required is $1,000. Installing heating and ventilating apparatus in new public school 13, on west side of Anderson St., between Pennsylvania and Clifton Aves., Rosebank, Borough of Richmond; security required is $13,000. Installing electric equipment in addition to and alterations in public school 19, on East side of Greenleaf, Ave., between Post Ave. and Floyd St., West New Brighton, Borough of Richmond; security required is $1,000

New York, N. Y.—Bids are asked by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., until 3 p. m., Aug. 12, for the general construction of a grandstand on the athletic field on Munson and Orchard Sts. and the East River, Astoria, Long Island City, Borough of Queens; security required is $12,000. Bids are also asked for general construction of a grandstand on the athletic field on Hamilton Ave. and St. Mark's Pl., New Brighton, Borough of Richmond; security required is $16,000.

West Point, N. Y.—Bids are asked by Major J. M. Carson, Jr., Quartermaster, until noon, Aug. 10, for furnishing and installing reinforcing for girder under south wall of library tower.

Cleveland, O.—Bids are asked by A. R. Callow, Secretary Board of Public Service, No. 105 City Hall, until noon, Aug. 12, for installing complete plumbing in the quadrangle building of the Cleveland Farm Colony, at Warrensville, O. Certified check for $1,000 required with bid.

Springfield Township, O.—Bids are asked by Wm. Fischvogt, Clerk Board of Education of Special School District No. 13, Springfield Township, Mt. Healthy, Ohio, R. F. D. No. 4, until noon, Aug. 27, for labor and material for constructing school house in Steele's sub-division. Certified check for $300 required with bid. Martin Fisher, Architect, 2156 Central Ave., Cincinnati, O.

Orient, O.—Bids are asked by Dr. E. J. Emerick, Secretary, Ohio Institution for

Feeble Minded Youth. Columbus, O., until noon, Aug 22. for furnishing materials and labor necessary to install complete the heating system in the dining hall, at the custodial farm, located at Orient.

Walter, Okla.—Bids are asked by Board of Education, Chas. G. Mudd, Clerk, until 2 p. m., Aug. 15, for constructing a 10-room school building.

Pittsburg, Pa.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Sept. 16, for the construction (except elevators) of the U. S. Marine Hospital, at Pittsburg.

Fort Myer, Va.—Bids are asked by Capt. B. B. Hyer, Constructing Q. M., until 11 a. m., Aug. 15, for alterations and additions to officers' quarters No. 1, signal corps post, Fort Myer, Va

Milwaukee, Wis.—Bids are asked by Milwaukee Auditorium Board, Room 45, University Bldg., until noon, Aug 20, for labor and material for erecting an auditorium building. Ferry & Clas, Architects, 410 Broadway, Milwaukee

Roads and Streets

(Items Arranged Alphabetically by States.)

Denver, Colo.—Bids are asked by T. W. Jaycox, State Engineer, until noon, Aug. 10, for the construction and repair of 17 miles of road located near Ault, Colo.

Bluffton, Ind.—Bids are asked by Frank S. Smith, City Clerk, until 7:30 p. m., Aug. 9, for paving portion of West Wiley Ave. with brick upon 5 ins. Portland cement concrete foundation. Bids are also asked for constructing cement combined curbs and sidewalks in portions of Williams St., Morgan St., West Central Ave. and Mulberry St.

Indianapolis, Ind.—Bids are asked by Board of Public Works, until 10 a. m., Aug. 9, for following work: Improvement of Meridian St. by resurfacing; first alley north of 32nd St., by grading, graveling and rolling roadway; Keystone Ave., by grading and paving sidewalks; Gale St., by grading and rolling roadway; 21st St., by grading and paving roadway; 27th St., by grading and paving roadway; 11th St., by grading and paving roadway; first alley west of College Ave., by grading and paving roadway.

South Bend, Ind.—Bids are asked by Board Public Works, until 10 a. m., Aug. 13, for constructing brick pavement on portion of Broadway and on first alley west of Michigan St.; also for grading, curbing and constructing walk in Bartlett St.

Richmond, Ind.—Bids are asked by Board Public Works, until Aug. 9, for macadamizing West 2nd St. between Sheridan St. and West 5th St.

Tipton, Ind.—Bids are asked by Commissioners of Tipton County, at Tipton, until 10 a. m., Aug. 19, for the construction of a gravel road.

Fort Riley, Kan.—Bids are asked by Capt W. M. Whitman, Constructing Q. M., until 11 a. m., Aug. 14, for the construction of 750 lin. ft. of macadam road and for furnishing and delivering where directed on present road system within this post approximately 2,500 cu. yds. of crushed rock.

Fort St. Philips, La.—Bids are asked by Capt. B. T. Clayton, Q. M., U. S. A., New Orleans, La., until noon, Aug 21, for constructing roads, drains and sidewalks at Fort St Philip, La.

Baltimore, Md.—Bids are asked by Board of Awards, until 11 a. m., Aug. 14, to construct a concrete footway along the west side of Patuxent St. between Baltimore St and Eastern Ave. Specifications, etc., with B. T. Fendall, City Engineer.

Ecorse, Mich.—Bids are asked by Richard C. Montie, Village Clerk, until 7 p. m., Aug 13, for paving with brick and sewering River Road. Certified check for $1,000 required with bid. George Jerome, Village Engineer, 1102 Majestic Bldg., Detroit, Mich.

Muskegon, Mich.—Bids are asked by P. P. Misner, City Recorder, until noon, Aug. 12, for labor and material for improvement of Western Ave. from Goodrich St. to Ottawa St., pavement with either brick, asphalt, asphalt macadam, or other first-class pavement.

Saginaw, Mich.—Bids are asked by Board Public Works, until Aug. 15, for macadamizing portions of Court St., State St. from Bay to Mackinaw; East St., Sheridan Ave., Washington Ave., Williamson St., and Brockway St. Bids are also asked for paving Hayden St. with asphalt.

New Ulm, Minn.—Bids are reported asked by City Clerk, until 5 p. m., Aug. 12, for grading, graveling and boulevarding Franklin St. from Center St. to First North St.; also for grading Wiesenthal Ave. and construction of necessary culverts.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., Aug. 15, for constructing artificial stone sidewalks on a number of streets. Bids are also asked for grading portions of 12 streets

Fort Lee, N. J.—Bids are asked by Michael Sullivan, Borough Clerk, until 8 p. m., Aug. 28, for grading Myrtle Ave. at Coytesville, in the Borough of Fort Lee. C. H. Eckerson, Borough Engineer, Englewood, N. J.

Hoboken, N. J.—Bids are asked by James H. Londrigan, City Clerk, until 8 p. m., Aug. 28, for repaving portions of four streets with Belgian block pavement.

Westfield, N. J.—Bids are asked by Town Council, Lloyd Thompson, Town Clerk, until 8 p. m., Aug. 19, for regulating, grading and macadamizing Euclid Ave. from Broad St. to Mountain Ave., the work including: Excavation, exclusive of subgrading, 555 cu. yds; 6-in. macadam, 3,837 sq. yds.; cobble gutters, 227 sq. yds. A. W. Vars, Town Surveyor, corner of Broad and Elm Sts., Westfield, N. J.

Brooklyn, N. Y.—Bids are asked by Bird S. Coler, Borough President, until 11 a. m., Aug. 14, for the work under 15 contracts for street improvements. Largest contract calls for regulating and repaving with asphalt pavement on a concrete foundation the roadway of Halsey St. from Broadway to Knickerbocker Ave., the Engineer's estimate of the quantities being as follows: 5,120 sq. yds. of asphalt pavement; 30 sq. yds of old stone pavement, to be relaid; 1,020 cu. yds. of concrete; 3,640 lin. ft. of new curbstone; 2,500 lin. ft of old curbstone, to be reset; 1 noiseless cover and head, complete, for sewer manhole.

New York, N. Y.—Bids are asked by J. A. Bensel Commissioner of Docks, Pier A Battery Pl., until noon, Aug. 14, for furnishing labor and material for repairing asphalt pavements along North and East River. The work is divided into sections, security for $30,000 being required for each section.

Illion, N. Y.—Bids are asked by Street Commissioners, Edw Y. Stewart, Village Clerk, until 8 p. m., Aug. 10, for the construction of about 2,300 sq. yds. of brick pavement on concrete foundation, together with the necessary excavation, curbing, catch basin, tile and such other work and materials as may be necessary for the proper completion of the pavement.

New York, N. Y.—Bids are asked by John H O'Brien, Commissioner Water Supply, Gas and Electricity, 13 Park Row, until 2 p. m., Aug. 14, for furnishing materials, repairing and restoring artificial stone sidewalks and curbing and resetting natural stone curbing Security required will be $500.

Syracuse, N. Y.—Bids are asked by Board Contract and Supply, George J. Metz, City Clerk, until 1.30 p. m., Aug. 12, for furnishing materials and constructing a number of stone, cement, asphalt and brick sidewalks.

Cincinnati, O.—Bids are asked by County Commissioners, Fred Dreihs, Clerk, until noon, Aug. 30, for the following county work: Under Specifications No. 602—For repair of Shady Lane road, between Maurer's and Warder's, Miami Township.

Cincinnati, O.—Bids are asked by County Commissioners, Fred Dreihs, Clerk, until noon, Aug. 16, for the following work: Under Specifications No. 620—For improvement of Hamilton Pike, from North Corporation Line of Mt. Healthy to Butler County Line, Springfield Township.

Columbus, O.—Bids are asked by Board Public Service, Edward F. McGuire, Secretary, until noon, Aug. 8, for improvement of portions of following streets by grading and paving roadway with asphalt, hard burned brick or block: Collins Ave., Fairwood Ave., Hunter Ave., Highland Ave., 9th Ave., Ogden Ave., Say Ave., 13th Ave., Wheatland Ave., Warren Ave., Whitethorne Ave and Linwood Ave.

New Philadelphia, O.—Bids are asked by Board Public Service, George C. Marsh, Clerk, until noon, Sept. 3, for construction of 10,600 sq. yds. of brick paving and 4,500 ft. of 8-in. pipe sewer Clyde J Knisely, City Engineer.

Ottawa, O.—Bids are asked by County Commissioners, until 11 a. m., Aug. 17, for constructing following stone roads in Palmer, Monroe and Van Buren Townships: Joseph Cox Road, 6 miles long; Brand Road, 1 mile long; D C. Henry Road, 3 miles long; G D Zimmerman Road, 2.5 miles long; Jacob Bright Road, 2 miles long; John Donnelly Road, 1.5 miles long; Jacob Fike Road, 1 mile long. J. T. Maidlow, County Surveyor.

Steubenville, O.—Bids are asked by Board Public Service, T. W. Vance, Clerk, until noon, Aug. 12, for paving Washington St. from east line of High St to east line of 3rd St.

Steubenville, O.—Bids are asked by Board Public Service, T. W. Vance, Clerk, until noon, Aug. 19, for paving with brick 7th St. from Logan St. to Ross St.

Springfield, O.—Bids are asked by Township Trustees, care W. A. Taylor, Township Clerk, Bergholz, O., until 3 p. m., Aug. 10, for the grading and macadamizing of five miles of road in Springfield Township between Bergholz and East Springfield. R. H. Lee, Engineer, Carrolton, O.

Struthers, O.—Bids are asked by C. Creed, Village Clerk, until noon, Aug. 12, for labor and material for grading Lowellville Ave.; also for laying crosswalks in the village.

Toledo, O.—Bids are asked by Board Public Service, Reynold Voit, Clerk, until noon, Aug. 9, for improvement of portion of Sherman St., by grading and paving with either vitrified paving blocks, sheet asphalt or creosoted wood blocks, laid on a foundation of concrete, or vitrified paving blocks, creosoted wood blocks, bithulithic pavement or other bituminous macadam. Bids are also asked for the similar improvement of a portion of Norwood Ave.

Toledo, O.—Bids are asked by D. T. Davis, Jr., County Auditor, until 10 a. m., Aug. 14, for the improvement of a part of county road known as Philips Ave.

Youngstown, O.—Bids are asked by

Board Public Service, W. H. McMillin, Clerk, until noon, Aug. 12, for labor and material for grading Maple Ave. from Willow St., to O. L. 48, and for grading Thurman St. from Rayen Ave. to Furnace St. Bids are also asked for paving Iona St. from Holmes to Ford Ave.

Pittsburg, Pa.—Bids are asked by F. P. Booth, County Controller, until noon, Aug. 26, for improvement of Perrysville plank road for a distance of 1.8 miles in Ross Township, and for the improvement of Homestead and Duquesne road for a distance of 5½ miles. Plans, etc., are on file in the office of Geo. T. Barnsley, County Road Engineer, Room No. 26, Court House, Pittsburg, Pa.

Pittsburg, Pa.—Bids are asked by Department of Public Works, until 10 a. m., Aug. 12, for the following work: Constructing board walks and steps in a number of wards; grading, curbing and paving with asphalt portions of five streets; grading, curbing and paving with block stone portions of four streets; grading, curbing and paving with brick portions of two alleys; grading and paving with brick one alley.

Marshall, Tex.—Bids are asked by H. S. Rice, City Secretary, until Aug. 14, for construction of 22 miles of concrete sidewalks and street crossings. Plans, etc., at office of William Bradburn, City Engineer.

Yorkstown, Va.—Bids are asked by County Supervisors, until Sept. 3, for constructing two miles of road. Plans, etc., with D. R. Norment, Magruder, Va.

Aberdeen, Wash.—Bids are asked by P. F. Clark, City Clerk, until 5 p. m., Aug. 21, for improvement of H St., I St., Broadway, K St., L St., 2nd St., 3rd St., 4th St., 5th St., G St., 7th St., Hopkins and 8th St., by clearing, grubbing, grading, graveling, constructing concrete curb and gutter, storm water outlets, retaining walls and other necessary improvements. Certified check for $1,500 required with bid.

Olympia, Wash.—Bids are asked by State Highway Board, Joseph M. Snow, Secretary, until 2 p. m., Aug. 16, and then opened, for clearing grubbing, grading and bridging, that portion of the Ferry County section of State Road No. 4 lying between Stations 707 and 774, 915 and 920, 1402 and 1433 and 2606, and building bridge No. 3 on San Poil River.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., Aug. 9, for labor and material to grade roadway and pave the same with a permanent asphalt pavement having a concrete foundation, and to curb the sidewalks with stone (old curbing to be reset) on Wells St. from the west line of 5th St. to the west line of 8th St. Certified check for $2,100 required with bid. Bids are also asked for grading roadway and paving with creosoted wooden blocks on Wells St. from 31st St. to 33rd St. Certified check for $1,300 required with bid.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., Aug. 8, for macadamizing and guttering portion of 4th St.; certified check for $400 being required with bid. Bids are also asked for macadamizing and guttering portion of Cherry St., certified check for $1,200 being required with bid.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., Aug. 13, for repaving with cedar block pavement on portions of Fond du Lac Ave., and Lisbon Ave.

Sewers.

Items Arranged Alphabetically by States.

Belvidere, Ill.—Bids are asked by Board Local Improvements, William L. Pierce, President, until 7:30 p. m., Aug. 8, for constructing 1,250 ft. of 8-in. sewer, 7 manholes and 1 flush tank.

Pekin, Ill.—Bids are asked by Board Local Improvement, John R. Seibert, Engineer, until 8 p. m., Aug. 12, for constructing sewer system to include 10,115 lin. ft. 8 in., 12,075 lin. ft. 12-in., 10,485 lin. ft. 15-in., 5,2[illegible]5 lin. ft. 18-in. and 5,105 lin. ft. 20 in. vitrified pipe sewer; 3,495 lin. ft. 18x27 in., 2,320 lin. ft. 20x30-in., 1,155 lin. ft. 22x33 in. (egg-shaped), 720 lin. ft. 24x36-in., 1,205 lin. ft. 26x39-in., 1,595 line. ft. 28x42-in., 330 lin. ft. 30x45-in., 320 lin. ft. 32x48-in., and 320 lin. ft. 34x51-in. brick sewer (egg-shaped); 320 line ft. 42 in., 600 lin. ft. 52-in. and 1,594 lin. ft. 62-in. brick sewer (circular). Plans, etc., with City Engineer and at the office of the Consulting Engineer, 203 Great Northern Bldg., Chicago, Ill. Bids for the above work were opened July 29, two proposals, one for $125,000, the other for $140,000, being received. Both proposals were rejected and the work readvertised. The city has disposed of its bond issue for the work.

Evansville, Ind.—As stated in our issue of July 24, bids are being asked by this city until 2 p. m., Aug. 30, for the construction of a reinforced concrete sewer or a brick sewer. The work includes 3,850 ft. of reinforced concrete sewer, 8 ft. in diameter; 1,400 ft. of reinforced concrete sewer, 7 ft. 6 ins. in diameter; 1,400 ft. of reinforced concrete sewer, 7 ft. in diameter; 1,220 ft. of reinforced concrete sewer, 6 ft. 6 ins. in diameter; 680 ft. of concrete sewer, 6 ft. in diameter; 1,3[illegible]4 ft. of reinforced concrete sewer, 5 ft. 6 ins. in diameter. The official advertisement will be found elsewhere in this issue.

Gas City, Ind.—Bids are asked by George S. Marshall, City Clerk, until 8 p. m., Aug. 13, for the construction of a sanitary and storm sewer system in different streets and alleys. Total length is about 3 1-10 miles, and approximate cost is $24,000. C. E. Petrie, Engineer, City Building, Marion, Ind. The official advertisement for this work appeared in our issue of July 31.

Indianapolis, Ind.—Bids are asked by Board of Public Works of Indianapolis until 10 a. m., Aug. 9, for the construction of a local sewer in Market and Davidson St. from Noble St. to the center of the second alley north of Market St.

Richmond, Ind.—Bids are asked by Board Public Works, until Aug. 9, for construction of a sewer to drain portion of West Richmond included between Sheridan St. and West 5th St., the first alley north of Chestnut St. and first alley north of State St.

South Bend, Ind.—Bids are asked by Board of Public Works, until 10 a. m., Aug. 13, for constructing pipe sewer on Emerson Ave. from Mishawaka Ave. to the St. Joseph river.

Iowa City, Ia.—Bids are asked by City Clerk, until Sept. 6, for construction of sewer in Bowery St. from Dodge to Lucas. J. O. Schultz is City Engineer.

Oelwein, Ia.—Bids are asked by City Council, until 8 p. m., Aug. 7, for construction of a sewage disposal plant. Plans, etc., with City Clerk. Certified check for $500 required with bid.

Milford, Mass.—Bids are asked by James F. Walker, Chairman Committee, until 8 p. m., Aug. 8, for the following work and materials in three contracts: (1) Constructing 7,000 ft. of 6-in. to 12-in. sewer, 800 ft. of 8-in. force main, a small concrete pump well and concrete pumping station; (2) for furnishing 800 ft. of 8-in. cast iron pipe; (3) for furnishing and erecting small electric pumping plant, consisting of motors and directly connected centrifugal pumps. F. A. Barbour, Engineer, Boston, Mass.

New Ulm, Minn.—Bids are asked by City Clerk, until 5 p. m., Aug. 12, for construction of a ditch and sewer from 10th North St. to 17th South St.

St. Paul, Minn.—Bids are asked by R. L. Gorman, Clerk, until 2 p. m., Aug. 15, for construction of a sewer on Cherokee Ave., from Alice St. to Ohio St.

Staples, Minn.—Bids are asked by this city, until 4 p. m., Aug. 15, for constructing a sanitary sewer consisting of about 9,000 ft. sewer lines and a small septic tank. O. Claussen, Consulting Engineer, 514 German-Am. Bank Bldg., St. Paul, Minn.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., Aug. 8, for constructing district sewers in sewer district No. 176.

Webster Groves, Mo.—Bids are asked by L. B. Ripley, City Clerk, until 8 p. m., Aug. 19, for the construction of district sewers with necessary appurtenances in Sewer District No. 1, the principal items of work being: 50,800 ft. of pipe sewer from 9 to 18 ins. diameter; 54 flush tanks; 1 septic sewage disposal plant, capacity 70,000 gallons daily. Bids are also asked for the construction of district sewers with necessary appurtenances in Sewer District No. 2, the principal items of work being: 42,800 ft. of sewer pipe from 9 to 15 ins. diameter; 49 flush tanks; 1 septic sewage disposal plant, capacity 42,000 gallons daily. Specifications, etc., at office of R. E. McMath Surveying Co., 328 Lincoln Trust Bldg., St. Louis, Mo., or City Clerk.

Omaha, Neb.—Bids are asked by Andrew Rosewater, City Engineer, until 2 p. m., Aug. 12, for constructing storm water sewers in California St., the work including 1,042 ft. of 42-in., 388 ft. of 36-in., 676 ft. of 33-in., 409 ft. of 30-in. and 1,084 ft. of 28-in. sewer, 10 manholes, 26 inlets and 1,040 ft. of 10-in. inlet pipe. Bids are also asked for constructing a number of 8-in., 10-in. and 12-in. pipe sewers.

Asbury Park, N. J.—Bids are asked by Department of Water and Sewers, John L. Coffin, Superintendent, until noon, Aug. 17, for furnishing all material, labor and appliances, and constructing about 10 miles of pipe sewers from 6 to 15 ins. in diameter, with manholes, lampholes, flush tanks and cast iron pipe. Bids are also asked for furnishing all labor, material and machinery, and laying 1,200 ft. of 12-in. wrought iron sewer outlet pipe, extending seaward from tide mark. Mart Rogers, City Engineer.

Riverside, N. J.—Bids are asked by Irwin [illegible], Township Clerk, until 8 p. m., Aug. 19, for constructing sewer system consisting of approximately ten miles of sewers 8 ins. to 24 ins. in diameter; pump house, engines, pumps, pump-well and disposal works. Wm. H. Boardman, Engineer.

Weehawken, N. J.—Bids are asked by Thomas Carroll, Township Clerk, until [illegible] p. m., Aug. 12, for constructing 24-in. pipe sewers, two 18-in. laterals and a 15-in. sewer.

Brooklyn, N. Y.—Bids are asked by Bird S. Coler, Borough President, until 11 a. m., Aug. 14, for the work under 13 contracts for constructing sewers, and the work under 10 contracts for sewer basins. Largest contract calls for furnishing all the labor and material required for constructing sewer in 17th Ave. from 50th St. to 60th

St., the engineer's estimate of the quantities being as follows: 200 lin. ft. of 36-in. brick sewer, 200 lin. ft 30-in. brick sewer, 200 lin. ft 24-in. brick sewer, 260 lin ft 18-in. pipe sewer, 1,020 lin. ft. 6-in. house connection drain, 9 manholes, 8 sewer basins, 1,000 ft. (b. m.) sheeting and bracing, 5 cu. yds. concrete cradle, 4,000 ft. (b. m.) foundation planking, 2 reconnecting sewer basins.

New York, N. Y.—Bids are asked by Henry S. Thompson, Commissioner Public Works, until 2 p. m., Aug. 12, for furnishing all the labor and material required for reconstruction of outlet sewers and appurtenances, overflows and connections, at 42nd and 43rd St., North River, and 42nd and 43rd Sts., between North River and 11th Ave. The work includes: 1,350 lin. ft. of wooden barrel sewer of 4 ft. 6 ins. interior diameter; 190 lin. ft. of brick sewer of 4 ft. 6 ins. by 9 ft. interior diameter, Class III; 170 lin. ft. of brick sewer of 6 ft. 6 ins. by 9 ft. interior diameter, Class V; 206 lin. ft. of brick sewer of 4 ft. by 2 ft. 8 ins. interior diameter, Class VIII; 123 lin. ft. of brick sewer of 4 ft. by 2 ft. 8 ins. interior diameter, Class IX.

Minot, N. D.—Bids are asked by this city, until Aug. 9, for constructing 12-in lateral sewers; estimated cost is $19,000. E. S. Severance, City Engineer.

Cleveland, O.—Bids are asked by A. R. Callow, Secretary of the Board of Public Service, No. 105 City Hall, until noon, Aug. 13, for the construction of sewers in the following streets and avenues between the points mentioned: Alice Ave., S. E., between East 71st St. and and East 74th St. (formerly E. 73rd Pl.); Barkwill Ave., S. E., between East 49th St. and west end of street; Chambers Ave., S. E., between East 69th St. and East 71st St.; Chard Ave., N. E., between East 49th St. and East 46th St.; Gooding Ave., N. E., be-East 105th St. and Parkwood Drive, N. E.; Irma Ave., S. E., between East 71st St. and East 74th St.; East 71st St. (Marcelline) between Old City Limits and New City Limits; East 74th St. (Reade) between Clement Ave., S. E., and Irma Ave., S. E.; Woodland Ave., S E., between Woodhill Rd., S. E., and City Limits.

Cleveland, O.—Bids are asked by A. R. Callow, Secretary of the Board of Public Service, City Hall, until noon, Aug. 15, for the construction of the East 125th St. sewer, jointly for the City of Cleveland and the Village of East Cleveland, between East 125th St. (Hower Ave.), between Superior Ave., N. E., and angle 975 ft. southerly. Certified check for $400 required with bid.

East Liverpool, O.—Bids are asked by Board Public Service, J. W. Gipner, Secretary, until noon, Aug. 12, for construction of sewer in Bradshaw Ave. and Tanyard Run.

New Philadelphia, O.—See under Bids Asked.—Roads and Streets.

Sandusky, O.—Bids are asked by Board Public Service, B. J. McGory, Clerk, until noon, Aug. 9, for labor and material for constructing sewer in Franklin and Finch Sts., in Pierce St. and Campbell St., in Scott and Finch Sts., and in North Depot St.

Youngstown, O.—Bids are asked by Board Public Service, W. H. M'Millin, Clerk, until noon, Aug. 12, for furnishing the necessary labor and materials for sewering Walnut St. from Erie R. R. tracks to Bane St., and Bane St. from Walnut St. to Market St.

New Castle, Pa.—Bids are asked by A. E. Rhodes, City Clerk, until 8 p. m., Aug. 12, for construction of sanitary sewer in Madison Ave. between Lafayette and Liberty Sts. Certified check for $50 required with bid.

Pittsburg, Pa.—Bids are asked by Department Public Works, until 10 a. m., Aug. 12, for constructing 15-in. pipe sewer in portions of Bartlett St., Chislett St., Wilhelm St. and Patterson alley.

Milwaukee, Wis.—Bids are asked by Board Public Works, until 10:30 a. m., Aug. 9, for constructing an outlet for the Deer Creek sewer, being a section of concrete sewer through the premises of the Illinois Steel Co., from the present terminus of the sewer to the shore of Lake Michigan, in the Seventeenth ward. Certified check for $300 required with bid .

Milwaukee, Wis.—Bids are asked by Board of Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., Aug. 13, for labor and material to construct and lay the house drains and water service connections on 22nd Ave. from National Ave. to Lincoln Ave., in the 11th and 23rd Wards. Certified check for $2,700 required with bid.

Water Supply

Items Arranged Alphabetically by States.

Dawson, Minn.—Bids are asked by this village, until 8 p. m., Aug. 20, for constructing a combined water works and electric light plant; estimated cost is $28,000. Oscar Clausen, 514 German Am. Bank Bldg., St. Paul, Minn., is Consulting Engineer.

New Ulm, Minn.—Bids are asked by City Clerk, until 5 p. m., Aug. 12, for laying water mains on Franklin St. from First North St. to Fifth North St., and Fourth North St. from Washington to Franklin St.

Carrington, N. Dak.—Bids are asked by City Council until Sept. 2, for the construction of a steel standpipe and foundation for a water works system. H. L. Winteror, City Auditor; E. I. Walton, Mayor.

Ashland, O.—Bids are asked by Board Trustees Public Affairs, until Aug. 26, for furnishing and erecting pumping plant at water pumping station.

Cleveland, O.—Bids are asked by A. R. Callow, Secretary of the Board of Public Service, No. 105 City Hall, until noon, Aug. 12, for installing complete a pressure tank system for the Quadrangle Building of the Cleveland Farm Colony at Warrensville, O.

Excavation—Earth and Rock

Items Arranged Alphabetically by States.

Mason City, Ia.—Drain.—Bids are asked by A. S. Clarke, County Auditor, until 1 p. m., Aug. 15, for labor and material for construction of county drain No. 5, the work including an open ditch 8,538 ft. long and containing about 7,645 cu. yds., included in section No. 1, to be a cement culvert 6 ft. by 7 ft. by 16 ft.; section No. 2 to be tile drains, 19,831 ft. long, all located in Pleasant Valley and Grimes Townships.

Weymouth, Mass.—Dredging.—Bids are asked by Maj. Edw. Burr, U. S. Engrs., Boston, Mass., until noon, Aug. 20, for dredging in Weymouth Back River, Mass.

Portland, Me.—Rock Excavation.—Bids are asked by Maj. George A. Zinn, U. S Engrs., 537 Congress St., Portland, until noon, Aug. 30, for rock excavation at Cape Porpoise Harbor, Me.

Brooklyn, N. Y.—Filling—Bids are asked by J. A. Bensel, Commissioner of Docks, Pier A, Battery Pl., New York, until noon, Aug. 16, for furnishing all the labor and materials required for furnishing and placing filling in rear of the ferry structures at 39th St. Borough of Brooklyn. Security required is $3,500.

New York, N. Y.—Filling.—Bids are asked by J. A. Bensel, Commissioner of Docks, Pier A, Battery Pl., until noon, Aug. 16, for furnishing all the labor and materials required for furnishing and placing filling in the rear of the ferry structures at Canal St., Stapleton. Security required is $1,500.

Block Island, R. I.—Dredging.—Bids are asked by Lt. Col. J. L. Willard, U. S. Engrs., until 11 a. m., Aug. 26, for dredging entrance channel to Great Salt Pond, Block Island, R. I.

Providence, R. I.—Dredging.—Bids are asked by Lt. Col. J. H. Willard, U. S. Engrs., Newport, R. I., until 11 a. m., Sept. 4., for dredging in Providence Harbor, R. I.

Charleston, S. C.—Dredging.—Bids are asked by Capt. E. R. Stuart, U. S. Engrs., Charleston, until noon, Aug. 20, for dredging canal between Sewee Bay and McClellanville, S. C.

Hawkins, Tex.—Levee Work.—Bids are asked by A. W. Campbell, 240 Main St., Dallas, Tex., until Aug. 10, for constructing about 10,000 ft. of levee, three miles from Hawkins.

Tacoma, Wash.—Dredging.—Bids asked by Major H. M. Chittenden, U. S. Engrs., Seattle, Wash., until noon, Sept. 2, for dredging Puyallup waterway, Tacoma, Wash., and bulkhead and filling adjacent tide lands. Funds available, $240,000.

Miscellaneous

Items Arranged Alphabetically by States.

Franklin Shoals, Ark.—Lock and Dam.—Bids are asked by Capt. G. M. Hoffman, U. S. Engrs., Vicksburg, Miss., until noon, Oct. 5, for building lock and dam No. 8 in Ouachita river at Franklin Shoals, Ark.

Washington, D. C.—Wrecking Buildings—Bids are asked by Major J. T. Crabbs, Constructing Q. M., Walter Reed Army General Hospital, Takoma Substation, Washington, until noon, Aug. 13, for demolishing buildings at Washington Barracks.

Washington, D. C.—Searchlight Outfit.—Bids are asked by Maj. E. Eveleth, Winslow, U. S. Engrs., U. S. Engineer School, Washington Barracks, D. C., until 11 a m., Sept. 30, for construction of experimental field searchlight outfit.

Jacksonville, Fla.—Jetty Work.—Bids are asked by Maj. Francis R. Shunk, U. S. Engrs., Jacksonville, until noon, Aug. 26, for building jetties at Biscayne Bay, Fla.

Chicago, Ill.—Concrete Work.—Bids are asked by John J. Hanberg, Commissioner Public Works, until 11 a. m., Aug. 10, for furnishing all material and labor and to construct and complete concrete covering for screen chamber and other miscellaneous construction work at the Carter H. Harrison, Sr., pumping station, Sections "O" and "M," intercepting sewers, according to plans and specifications on file in the office of the Department of Public Works, Room 221, City Hall.

Indianapolis, Ind.—Fire Cistern.—Bids are asked by the Board of Public Works, of Indianapolis, until 10 a. m., Aug. 12, for the construction of a fire cistern in Daly St. between Pine and Cruse Sts.

Louisville, Ky.—Retaining Wall.—Bids are asked by Board of Public Works, Roger G. McGrath, Secretary, until noon, Aug. 12, for the reconstruction of a retaining wall along Beargrass Creek Cut-off south of Van Buren St. Certified check for $250 required with bid.

Baltimore, Md.—Pier Work.—Bids are asked by Board of Awards, until 11 a. m., Aug. 14, for the construction of a pile and timber pier and for certain other work connected therewith. Certified check for $300 required with bid. Plans, etc., with O. F. Lackey, Harbor Engineer.

St. Joseph, Mo.—Pile Work.—Bids are asked by Board Public Works, Geo. F. Barnes, Clerk, until 11 a. m., Aug. 8, for repairing and reconstructing pile retaining work on the west side of Sixth St. at Atchison St. Certified check for $100 required with bid.

Jersey City, N. J.—Garbage Removal.—Bids are asked by Board of Street and Water Commissioners, Geo. T. Bouton, Clerk, until 2 p. m., Aug. 12, for collection and removal of ashes and garbage and kitchen refuse from all the streets of Jersey City, N. J., in accordance with specifications for same on file in the office of the Clerk of this Board.

Union, (P. O. Hoboken), *N. J.*—Garbage Removal.—Bids are asked by Emil Bautz, Town Clerk, until 8 p. m., Aug. 12, for the removal of garbage from the streets, avenues and thoroughfares of the Town of Union, for one year.

Fort Ontario (Oswego), N. Y.—Fence.—Bids are asked by Lieut. W. F. Harrell, Constructing Q. M., until 11 a. m., Aug. 20, for construction of an iron and wire fence at this post.

New York, N. Y.—Pier Work.—Bids are asked by J. A. Bensel, Commissioner of Docks, Battery Pl., until noon, Aug. 15, for furnishing all the labor and materials required for preparing for, repairing and rebuilding a portion of the pier at the foot of West 132nd St., North River, known as Pier No. 122. Security required is $3,000.

New York, N. Y.—Coal Vault.—Bids are asked by Board of Trustees, Bellevue Hospital, 26th St. and 1st Ave., until 3 p. m., Aug. 12, for providing all labor and materials required for the tearing down and removal, excavation, masonry, steel and iron, electric and all other work for the erection and entire completion of a coal vault at Gouverneur Hospital, situated at Gouverneur Slip, between Front St. and Water St., in the Borough of Manhattan, the city of New York. Surety required will be $1,500. Plans, etc., with the Contract Clerk, 419 E. 26th St.

New York, N. Y.—Electric System.—Bids are asked by Robert W. Hebberd, Commissioner of Charities, foot of E. 26th St., until 2:30 p. m., Aug. 22, for all materials and labor required for the complete conduiting, electric wiring, and all other work in connection with the installation of a complete electric lighting and power system for all the buildings and grounds under the jurisdiction of the Department of Public Charities, and comprising the New York City Home for the Aged and Infirm, Blackwell's Island, Borough of Manhattan, the city of New York. Surety required will be $20,000. Raymond F. Almirall, Architect, 51 Chambers St.

Cleveland, O.—Brick Chimney.—Bids are asked by A. R. Callow, Secretary Board Public Service, City Hall, until noon, Aug. 12, for erecting complete a brick chimney for the boiler house of the Cleveland Farm Colony, at Warrensville, O.

Cincinnati, O.—Tracks, Grading, Etc.—Bids are asked by Board of Trustees, "Commissioners of Water Works," Elmer G. Prior, Clerk, until noon, Aug. 27, for constructing narrow gauge coal and ash handling tracks, and for laying an 8-in filtered water pipe at the River Pumping Station, and for grading, sodding, and constructing driveways, walks and other work in connection therewith, and the delivery of track material at the main pumping station.

Toledo, O.—Monument.—Bids are asked by Wm. Corlett, Secretary Fort Meigs Memorial Commission, U. S. Internal Revenue Office, Toledo, until noon, Aug. 24, for a suitable memorial to be erected at Ft. Meigs, Wood County, Ohio, at a cost not to exceed $14,000, including its foundation. Bids must be accompanied by specifications, statement of proposed dimensions, design, material, plan and elevation showing all the exact measurements. This memorial is to be erected by the contractor with such inscriptions as will be approved, and in the position to be designated by the commission.

Youngstown, O.—Hauling Pipe.—Bids are asked by Board Public Service, W. H. McMillan, Clerk, until noon, Aug. 2, for labor and material for hauling 400 tons or less of cast iron water pipe.

Philadelphia, Pa.—Suction Dredges.—Bids are asked by Maj. J. C. Sanford, U. S. Engrs., 815 Witherspoon Bldg., Philadelphia, Pa., until 2:30 p. m., Aug. 30, for constructing two steel twin screw suction dredges for New York harbor, N. Y.

Pittsburg, Pa.—Concrete Wall.—Bids are asked by Department Public Works, City Hall, until 10 a. m., Aug. 12, for constructing concrete retaining wall on Mission St.

Galveston, Tex.—Jetty Work.—Bids are asked by Capt. John C. Oakes, U. S. Engrs., Galveston, until noon, Aug. 31, for jetty work at Galveston, Tex.

Materials, Machines, Supplies, Tools, Et

Items Arranged Alphabetically by States.

Huntsville, Ala.—Sewer Pipe, Brick.—Bids are asked by the Mayor, until Aug 10, for furnishing sewer pipe as follows: 50,000 feet 8-in. sewer pipe, 2,500 8-in.x4-in. Y's, 2,000 ft. 10-in. sewer pipe, 120 10-in.x4-in. Y's, 750 ft. 12-in. sewer pipe, 40 12-in.x4-in. Y's. Bids are also asked for furnishing 1,000,000 vitrified brick, best quality, standard sizes.

Mare Island, Cal.—Brick, Timber, Etc.—Bids are asked by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 20, to furnish at the navy yard, Mare Island, Cal., a quantity of naval supplies, as follows: Schedule 137—Brick, windows, lumber, piles, paper wall board. Schedule 138—Redwood, Oregon pine.

San Francisco, Cal.—Motors, Chain Drives, Etc.—Bids are asked by Custodian U. S. Post Office and Court House, San Francisco, until noon, Aug. 29, for furnishing and delivering motors, rheostats, chain drives, air compressor, circuit breaker, conduit, wire, etc., at the U. S. Post office and Court House, etc., San Francisco, Cal.

Washington, D. C.—Elevators.—Bids are asked by Elliott Woods, Superintendent, U. S. Capitol Buildings and Grounds, Washington, until noon, Aug. 4, for two passenger elevators for the U. S. courthouse, Washington.

Washington, D. C.—Steel Dump Barges.—Bids are asked by D. W. Ross, General Purchasing Officer, Isthmian Canal Commission, until 10:30 a. m., Aug. 12, for furnishing under Circular 380 three steel dump barges of a capacity of not less than 350 nor more than 400 cu. yds.

Washington, D. C.—Pipe, Valves, Etc.—Bids are asked by D. W. Ross, General Purchasing Officer, Isthmian Canal Commission, until 10:30 a. m., Aug. 9, for furnishing under Circular 379, Cast-Iron Pipe and Fittings, Gate Valves, Vitrified Sewer Pipe, Rubber Valves, Rivet Punches, Electric Fixtures, Gauge Testing Machine, Steel, Dipper Arm for Dipper Dredge, Repair Parts for Steam Shovels. Supplies include: 3,000 ft., 4-in., and 5,000 ft., 6-in. standard cast iron bell and spigot pipe, 30 4-in.x4-in.x4.-in., and 10 10-in.x10-in.x10-in. tees and 15 cast iron ¼ bends, 10-in.; 20,000 ft. standard vitrified sewer pipe, 6-in., 400 6-in. bends, and 200 6-in.x6-in. Y's.

Washington, D. C.—Tank, Emery Wheels, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 6, to furnish at the navy yard, Washington, D. C., a quantity of naval supplies, among which are the following: Schedule 119—Copper tubing, sheet copper, brass, lead, galvanized steel, black iron, and tin. Schedule 120—Ebonite, hardware, steel tank. Schedule 125—Emery wheels, diamond points, drill chucks, taps, oilstones, reamers, turning tools, saws, drills, files, file handles and brushes, tool holders, tools. Schedule 126—White and yellow pine. Schedule 127—Drill rod. Schedule 129—Lubricating oils.

Washington, D. C.—Track Scales, Tanks, Etc.—Bids are asked by D. W. Ross, General Purchasing Officer Isthmian Canal Commission, until 10:30 a. m., Aug. 14, for furnishing under Circular No. 381, track scales, motor car, railway water tanks and accessories, duplex pumps, boilers, steel, brass, taper pins, drag scrapers, friction wheels for dredge, dipper lips for steam shovels, ore cement; life preservers, rafts and buoys; sand and stone sieves, agate bearings, mechanical shakers, cement testing apparatus, thermometers, drafting machines, white edge scales.

Washington, D. C.—Navigators' Supplies, Drills, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 13, to furnish at the navy yard and Naval Observatory, Washington, D. C., as specified, a quantity of naval supplies, among which are the following: Schedule 147—Binoculars, spyglasses, boat and deck clocks, psychometers, clinometers, sextants, octants, stadimeters, artificial horizons, barometers, thermometers, reading glasses, protractors, parallel rulers, navigator's dividers, etc. Schedule 148—Air drills, sheet copper and lead, pyrites. Schedule 151—Deskfans, incandescent lamps, insulating tape, carbons, globes and repair parts for arc lamps, lamp cord, office and rubber-covered wire, switches, flexible steel conduit, electrical supplies.

Washington, D. C.—Engine, Tanks, Etc.—Bids are asked by D. W. Ross, General Purchasing Agent, Isthmian Canal Commission, until 10:30 a. m., Aug. 22, for furnishing under Circular No. 382 the following: Sanitary fixtures, soil pipe and fittings, railway water tanks and standpipes, D. C. engine and dynamo, switchboard, shop machines, locomotive springs, fly-ball, governors, electrical fixtures, magneto batteries, wire, hand drills, hammers, gongs, ship's felt, saws, vise, galvanized-iron roofing, chain, buckets, ground glass, laundry bags, range, safes, desks, chairs, bookcases, filing cabinets, K. D. boxes, etc.

Pensacola, Fla.—Fire Engines, Flat Cars.—Bids are asked by Bureau of Supplies and Accounts, Navy Dpartment, Washington, D. C., until 10 a. m., Aug. 6, for furnishing at Pensacola Navy Yard the following: Schedule 93—Two flat, and two chemical fire engines.

Pensacola, Fla.—Timber, Brick, Cement, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug 13, to furnish at the navy yard, Pensacola, Fla., a quantity of naval supplies, as follows: Schedule 140—Yellow pine, metallic shingles, galvanized iron coping, etc Schedule 141—White oak, hackmatack knees, yellow pine. Schedule 142—Brick, fire brick and clay, Portland cement, oakum, calking cotton, sheathing and wire nails, spikes, bilge pumps, windlasses, hard-

[illegible] copper sheathing, galvanized iron, bar steel, pitch, copper and black paint.

Louisville, Ky.—Pumping Engine.—Bids are asked by Louisville Water Co., 549 Third St., until noon, Sept. 8, for a compound beam and flywheel pumping engine of the Leavitt type of 16,000,000, 20,000,000, or 24,000,000 gallons capacity per twenty-four hours. Also for two horizontal firebox tubular Belpaire boilers; for one vertical triple expansion crank and fly wheel pumping engine, 24 or 30 million gallons capacity per twenty-four hours, for the Crescent Hill Pumping Station, and for one battery of two boilers similar to those in use now at the Crescent Hill Pumping Station.

New Orleans, La.—Tile Drain Pipe.——Bids are asked by Bureau Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 13, for furnishing at Naval Station, New Orleans, under Schedule 140, a quantity of tile drain pipe.

Boston, Mass.—Blueprint Paper, Filing Cabinets, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 6, to furnish at the navy yard, Boston, Mass., a quantity of naval supplies, among which are the following: Schedule 94—Milling attachment. Schedule 118—Type and filing cabinets, blueprint paper, etc. Schedule 120—Spruce, yellow pine. Schedule 121—Electric operating equipment.

Boston, Mass.—Boring Machines, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 13, to furnish at the navy yard, Boston, a quantity of naval supplies, among which are the following: Schedule 135—Vertical boring mill, pipe flanging machine. Schedule 147—Binnacles. Schedule 148—Anchors, chain cable, shackles, etc., valves.

Milford, Mass.—Pipe, Pumping Plant.—See under Bids Asked—Roads and Streets.

Detroit, Mich.—Fir Timber.—Bids are asked by Col. Charles E. L. Davis, U. S. Engrs., Jones Bldg., Detroit, until 3 p. m., Aug. 26, for furnishing and delivering at St. Marys Falls Canal, Mich., about 600,000 ft., b. m., of fir timber.

Kansas City, Mo.—Steel Pipe.—Bids are asked by Board of Public Works, Everett Elliott, Secretary, until 2 p. m., Sept. 3, for the manufacture and delivery, f. o. b. cars, at Kansas City, of 1,000 lin. ft. of riveted steel pipe having a minimum internal diameter of 48 ins., made of soft steel plate ½ in. thick, and in accordance with plans and specifications on file in the office of the Water Department.

Kansas City, Mo.—Pipe and Specials.—Bids are asked by Board of Public Works, Everett Elliott, Secretary, until 2 p. m., Sept. 3, for the manufacture and delivery, f. o. b. cars, at Kansas City, of the following items of cast iron pipe and special castings: Item No. 1. The annual supply of cast iron pipe from 4 ins. to 16 ins. in diameter. Item No. 2. The annual supply of cast iron pipe from 20 ins. to 42 ins. in diameter. Item No. 3. 2,200 tons of 48-in. cast iron pipe. Item No. 4. Special castings for pipe 24 ins. and greater in diameter, approximate quantity, 50 tons.

Portsmouth, N. H.—Barrows, Shovels, Pipe, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 13, to furnish at the navy yard, Portsmouth, N. H., a quantity of naval supplies, among which are the following: Schedule 150—Motor. Schedule 153—Bolts and nuts, wood screws, drills, files, hinges, nails, wheelbarorws, shovels, saws, hardware. Schedule 154—White pine, spruce. Schedule 155—Zinc plates, tool steel. Schedule 156—Linen fire hose, hard rubber, packings. Schedule 157—Cement compound. Schedule 158—Brass, copper, and galvanized pipe, pipe fittings, valves. Schedule 160—Fire brick.

Newark, N. J.—Electric Equipment.—Bids are asked by Council Committee, until 7:45 p. m., Aug. 23, for the following: (1) Three engines and three electric generators, steam piping, etc.; (2) Switchboard instruments, wiring, etc.; (3) Foundations and mason work; (4) Entire equipment. Plans and specifications, also form of proposals for the above work and materials may be obtained at the office of James M. Seymour, Jr., Consulting Engineer, 51 Lawrence St., Newark, N. J.

Trenton, N. J.—Vacuum Plant.—Bids are asked by State House Commission, at the office of the State Comptroller, Trenton, N. J., until noon, Aug. 13, for the installing of a vacuum cleaning plant in the State House. Specifications at the office of the Custodian of the State House, Trenton, N. J.

West Hoboken, N. J.—Street Signs.—Bids are asked by J. P. McMahon, Town Clerk, until 8 p. m., Aug. 14, for furnishing 800 blue enameled street signs.

New York, N. Y.—Road Rollers.—Bids are asked by Louis F. Haffen, President Bronx Borough, 177th St. and 3rd Ave., until 11 a. m., Aug. 6, for furnishing and delivering two new double cylinder steam road rollers, horizontal boilers, Buffalo pitts, or equal (size 15 gross tons); to be furnished and delivered to the yard of the bureau of highways within 30 days from date of execution of the contract.

New York, N. Y.—Motor Generator Sets, Etc.—Bids are asked by Francis J. Lantry, Fire Commissioner, 157 E. 67th St., until 10:30 a. m., Aug. 7, for furnishing all the labor and materials required for installing two motor generator sets and switchboards for the fire alarm telegraph in the fire alarm telegraph central office Town Hall, Jamaica, Borough of Queens.

New York, N. Y.—Pipe, Electrical Supplies.—Bide are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 13, to furnish at the navy yard, New York, N. Y., a quantity of naval supplies, among which are the following: Schedule 117—Searchlight projectors, carbons, engine revolution indicators, generating sets, incandescent lamps, bells and buzzers, portable testing sets, testing generators, electric soldering irons, keyboards, gonda cells, fuse wire, fuses, dynamotors, sockets, interior fittings and fixtures, push buttons, plugs, branch boxes, lanterns, globes, etc., switch handles, steel and brass enameled conduit and fittings, conductor, cable, bell wire. Schedule 134—Hydraulic accumulator. Schedule 155—Rolled bronze, brass sheet, bar iron, plain and corrugated galvanized sheet steel, bar and plate steel, sheet tin and zinc. Schedule 158—Iron or steel pipe, pipe fittings, brass unions.

New York, N. Y.—Lumber.—Bids are asked by Commissioner of Docks, Pier A, Battery Pl., until noon, Aug. 15, for furnishing under contract No. 1058 (Class 3), all the labor and materials required for furnishing lumber. Security required is $5,500.

New York, N. Y.—Vacuum Sweeping Plant.—Bids are asked by Board of Trustees, Bellevue Hospital, until 3 p. m., Aug. 12, for all the labor and material required for a vacuum dust sweeping and cleaning plant, in the pathological department and male dormitory of the new Bellevue Hospital, situated on First Ave. and bounded by Twenty-sixth and Twenty ninth Sts., Borough of Manhattan, the city of New York. Plans and drawings may be seen at the office of the Contract Clerk, No. 410 East 26th St.

Tompkinsville, N. Y.—Lantern.—Bids are asked by the Light House Engineer, Tompkinsville, N. Y., until 1 p. m., Aug. 22, for furnishing one first order lantern for Makapuu Point, Hawaii, light station.

Tompkinsville, N. Y.—Moorings.—Bids are asked by Light House Inspector, Tompkinsville, N. Y., until 2 p. m., Aug. 21, for furnishing and delivering moorings for vessels, and buoys of the light house establishment during the fiscal year ending June 30, 1908. The articles to be furnished embrace chain for light-vessels, chain for buoys, mushroom anchors, bridle chains, swivels for light vessel chain, and light vessel, buoys and anchor-shackles.

West Point, N. Y.—Lamp Posts, Lanterns.—Bids are asked by Major J. M. Carson, Jr., Q. M., until noon, Aug. 19, for furnishing iron lamp posts and lanterns for electric street lights.

Cleveland, O.—Water Meters.—Bids are asked by A. R. Callow, Secretary of Board of Public Service, No. 105 City Hall, until noon, Aug. 8, for furnishing and delivering to the Water Works Division of the Board of Public Service of the City of Cleveland, O., 5,000 $\frac{5}{8}$-in. water meters, with the privilege of 10,000.

Cleveland, O.—Oak Lumber.—Bids are asked by A. R. Callow, Secretary of the Board of Public Service, No. 105 City Hall, until noon, Aug. 5, for furnishing white oak lumber for repairing city bridges; approximate quantity—300,000 ft.

Cleveland, O.—Meter Manhole Rings.—Bids are asked by A. R. Callow, Secretary of the Board of Public Service, City Hall, until noon, Aug. 8, for furnishing and delivering to the Water Works Division of the Board of Public Service during 1907, 275 tons of meter manhole rings and covers. Specifications and blank proposals can be obtained at the office of the Superintendent of Water Works.

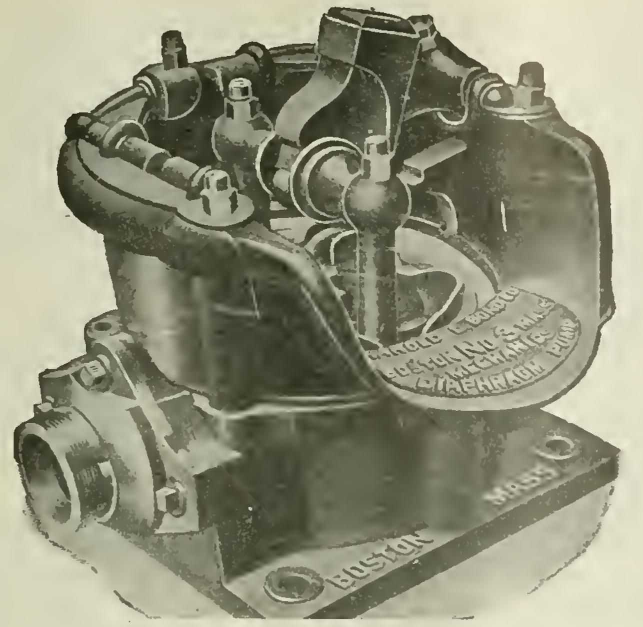
Cleveland, O.—Boiler, Superheater, Etc.—Bids are asked by A. R. Challow, Secretary of the Board of Public Service, No. 105 City Hall, until noon, Aug. 8, for one water tube boiler, one superheater, smoke flue connections and one stoker.

Saint Bernard (P. O., Cincinnati,) O.—Air Compressor.—Bids are asked by Board Trustees Public Affairs, Wm. J. Voller, Clerk, until Aug. 12, for labor and material for installing an air compressor and accessories for pumping water.

Norfolk, Va.—Lathe, Cement, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 6, for furnishing at the navy yard, Norfolk, Va., a quantity of naval supplies, as follows: Schedule 94—Turret lathe. Schedule 118—Arches and jamb bricks, retort cement, boiler tubes. Schedule 125—Gauge glasses and grommets. Schedule 128—Miscellaneous packings. Schedule 131—Portland cement. Schedule 132—Blueprint paper and cloth, solar paper, drawing paper and materials, photographic materials.

Halifax, N. S.—Meters.—Bids are asked by the Mayor care J. J. Hopewell, Clerk of Works, until noon, Aug. 13, for supplying 2,000 ½-inch water meters and 100 ¾-inch water meters. Further particulars may be obtained at the City Engineer's office.

Manila, P. I.—Valves, Gates.—Bids are asked by Municipal Board, J. F. Case, Chief Engineer, until noon, Sept. 14, for furnishing and delivering at ship's side in Manila, P. I., certain valves and sluice gates for use in the gravity water supply of the city. Specifications, etc., at office



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of the Board, and Bureau of Insular Affairs, Washington, D. C.

CONTRACTS LET.

Items Arranged Alphabetically by States.

Medina, O.—Water Pipes, Filter Work.—Bids were opened June 21 for laying water mains and development of natural filter for this place, the contract being awarded to T. C. Brooks & Sons, Jackson, Mich., at the following bid:

Excavation in trench, 24,432 ft.	$ 0.12
4-in. cast iron pipe, laid, 7,600 ft.	0.42
6-in. cast iron pipe, laid, 1,566 ft.	0.70
8-in. cast iron pipe, laid, 13,338 ft.	1.09
12-in. cast iron pipe, laid, 50 ft.	2.04
Cast iron specials, 1½ tons	100.00
4-in. valves with box, 28	12.75
6-in. valves with box, 9	17.85
8-in. valves with box, 17	23.85
Hydrants, 16	33.00
8-in. vitrified pipe, laid, 730 ft.	0.20
6-in. vitrified pipe, laid, 630 ft.	0.20
Excavation at river, 693 yds.	1.20
Concrete, 76 cu. yds.	10.00
1-in. steel rods, 4 ft. long, 10	0.20
Gravel backing, 36 cu. yds.	0.50
Flashboards, ½ M	30.00

E. G. Bradbury and G. P. Shute, Engineers, Columbus, O.

Green Bay, Wis.—Sewers.—Contracts amounting to $10,000 for the construction of 15 sewers have been let to Herman Schaefer and to Lagers & Kapinski.

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Bids Wanted on Concrete and Brick Sewers.

Evansville, Ind., July 15, 1907.

Notice to Contractors:

Notice is hereby given by the board of public works of the city of Evansville, Indiana, that sealed proposals will be received by it at its office up to the hour of 2 o'clock p. m. on 30th day of August, 1907, for the following described public improvements in the city of Evansville, as authorized by the improvement Resolution No. 2, 1907:

3,850 feet of reinforced concrete sewer, 8 feet in diameter.

1,400 feet of reinforced concrete sewer, 7 feet 6 inches in diameter.

1,400 feet of reinforced concrete sewer, 7 feet in diameter.

1,220 feet of reinforced concrete sewer, 6 feet 6 inches in diameter.

680 feet of reinforced concrete sewer, 6 feet in diameter.

1,364 feet of reinforced concrete sewer, 5 feet 6 inches in diameter.

Together with manholes, inlets, catch basins, outflow connections for branches and house connections.

The sewer to be known as the Kentucky avenue sewer.

All work done in the making of said described public improvement shall be in accordance with the terms and conditions of the improvement resolution as numbered, and the detail, plans, profiles, drawings and specifications which are on file and may be seen in the office of said board of public works of the city of Evansville, Ind.

Bids will also be received at the same time and place on brick sewer of the following dimensions:

3,850 feet, 7-0x9-0½, egg-shaped sewer.
1,400 feet, 6-8x8-7½, egg-shaped sewer.
1,400 feet, 6-2x8-0, egg-shaped sewer.
1,220 feet, 5-6x7-1 1-3, egg-shaped sewer.
680 feet, 5-2 2-5x6-8 2-5, egg-shaped sewer.
1,364 feet, 4-9½x6-2½, egg-shaped sewer.

Together with manholes, inlets, catch basins, outflow connections for branches and house connections.

The bidders in submitting proposals to make said described public improvements must accompany each bid with a certified check in a sum of not less than $5,000, as evidence of good faith that the successful bidders will execute within ten days from the acceptance of such proposals, contracts and bonds satisfactory to said board to do the work of making said improvements and comply with the conditions required by the specifications.

A failure of the successful bidders to enter into such contracts and bonds upon the acceptance of such proposals will forfeit the checks and the sums of money payable thereon to the city of Evansville as agreed and liquidated damages for such failure.

The bidders must also file with their bids an affidavit showing that the bid is made in good faith and that the bidder has not entered into any combination, collusion or agreement with any person or corporation for controlling the price to be bid, or attempted to prevent or induce any one to refrain from bidding in accordance with the requirement of section 95 of an act entitled an act concerning municipal corporations approved March 6th, 1905.

The board of public works reserves the right to reject any or all bids.

By order of the Board of Public Works.
6-1t WALTER F. WUNDERLICH Clerk

Substructure South Ashland Ave. Bridge, Department of Public Works.

Chicago July 22 1907

Sealed Proposals will be received by the city of Chicago until 11 a. m., Saturday, August 17, 1907, at room 224 City Hall, for

Eastern Headquarters:
415 Water St. Pittsburg, Pa.
THOS. GRADY, Sec'y.
12 Fifth St. Bayonne, N. J.
JOSEPH BRADY, Sec'y.

COMPETENT and PRACTICAL ENGINEERS and CRANEMEN Furnished by the
Associated Union of Steam Shovel and Dredgemen
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Room 606, 269 Dearborn St., Chicago, Ill.
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Western Headquarters:
South San Francisco California
WM. GALLAGHER, Sec'y.
1108 13th Ave., Seattle Wash.
H. V. TUCKER, Sec'y.

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THOS. J. DOLAN, Sec'y-Treas.
Headquarters, 134 Monroe St., Rooms 508, 509 and 510.
Long Distance Telephone 4222 Central.
CHICAGO, ILL.

the furnishing, delivering and building in place all temporary work, and for furnishing all materials, tools, labor, and all appliances and appurtenances required in the performance of all necessary operations for the complete construction and erection of the substructure for a drawbridge over the west arm of the south fork of the south branch of the Chicago river at South Ashland avenue, according to plans and specifications on file in the office of the Department of Public Works of said city, room 326 city hall.

Proposals must be made out upon blanks furnished at said office and be addressed to said department, indorsed "Proposals for Substructure, South Ashland Avenue Bridge," and be accompanied with three thousand dollars in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago and made payable to the order of the commissioner of public works.

The commissioner of public works reserves the right to reject any or all bids.

A deposit of five dollars will be required for the safe return of plans and specifications.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the commissioner of public works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

JOHN J. HANBERG.
6-2t Commissioner of Public Works.

Superstructure South Ashland Ave. Bridge, Department of Public Works.

Chicago, July 22, 1907.

Sealed proposals will be received by the city of Chicago until 1[illegible] a. m., Saturday, August 17, 1907, at room 224 City Hall, for the furnishing, delivering and building in place all temporary work and in furnishing all materials, tools, labor and all appliances and appurtenances required in the performance of all necessary operations for the complete construction and erection of the superstructure of a drawbridge over the west arm of the south fork of the south branch of the Chicago river at South Ashland avenue, according to plans and specifications on file in the office of the Department of Public Works of said city, room 326, City Hall.

Proposals must be made out upon blanks furnished at said office and be addressed to said department, indorsed "Proposals for Superstructure, South Ashland Ave. Bridge," and be accompanied with three thousand dollars in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago and made payable to the order of the commissioner of public works.

The commissioner of public works reserves the right to reject any or all bids.

A deposit of ten dollars will be required for the safe return of plans and specifications.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the commissioner of public works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

JOHN J. HANBERG.
6-2t Commissioner of Public Works.

STORM WATER SEWERS.

Omaha, Neb., July 29, 1907.

Sealed proposals will be received at the office of the City Engineer up to 2 o'clock p. m., Monday, August 26th, for the construction of storm water sewers and appurtenances as per plans and specifications on file in the office of the City Engineer.

The work to be done embraces approximately as follows:

840 feet sewer, 10 feet in diameter.

860 feet sewer, 11 feet 3 inches in diameter.

1,440 feet sewer, 12 feet in diameter.

250 feet, more or less, of 16 by 7½ reinforced concrete construction.

80 feet sewer 42 inches in diameter.

1,600 feet sewer, 30 inches in diameter.

150 feet open ditch work.

Payment for said work to be made upon a cash basis; 90 per cent on monthly estimates; an additional 5 per cent when work is accepted, and 5 per cent in one year after the completion of the work. Each bid shall be accompanied with a certified check in the sum of $3,000.00 as guarantee of good faith that the bidder will promptly enter into contract if award shall be made to him. The city reserves the right to reject any or all bids.

ANDREW ROSEWATER,
5-4t City Engineer.

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Monessen, Pa.

Notice is hereby given, by order of the Streets and Roads Committee of the Borough of Monessen, Pennsylvania, sealed proposals will be received at the office of the Borough Engineer until 6:00 P. M., August 9th, 1907, for the grading, curbing and paving of approximately, 17,500 square yards of paving with vitrified block. Plans and specifications are on file in the office of the Borough Engineer.

Each bid must be accompanied by a certified check for $500.00, which will be returned to the successful bidder on execution of the contract; or forfeited if he should fail to enter into and execute the contract awarded him, in which case, Council may accept any other bid.

All other checks will be retained until the contract is signed, when they will be returned. The right is reserved to reject any or all bids.

W. A. MILLER,
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J. F. IRWIN,
4-3t Borough Engineer.

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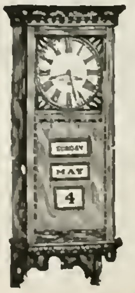

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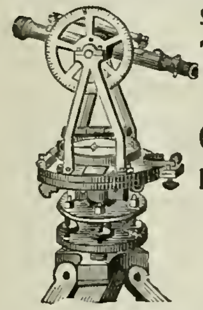

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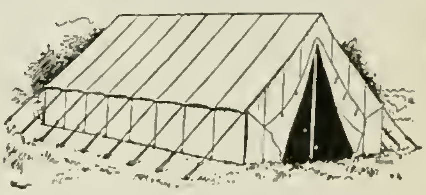

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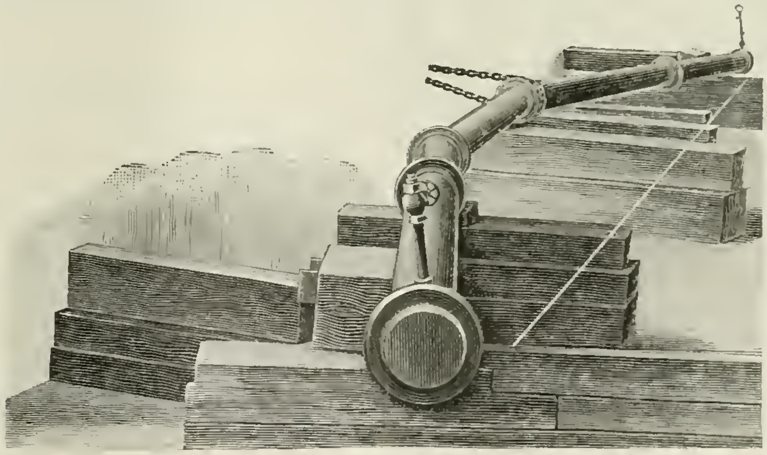

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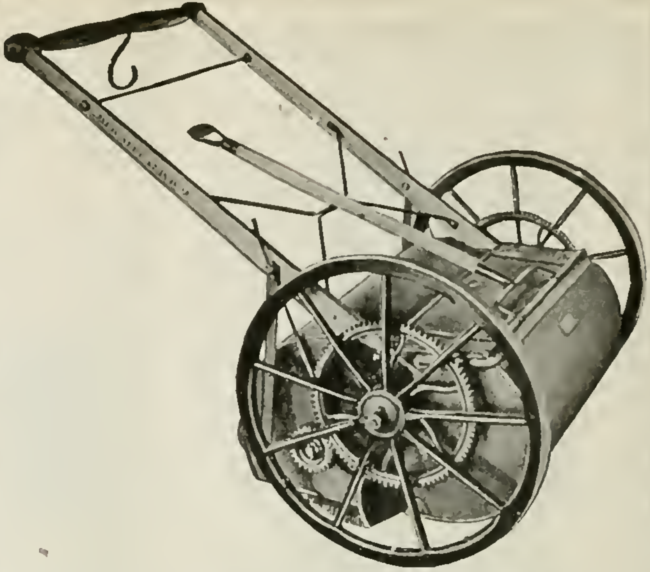

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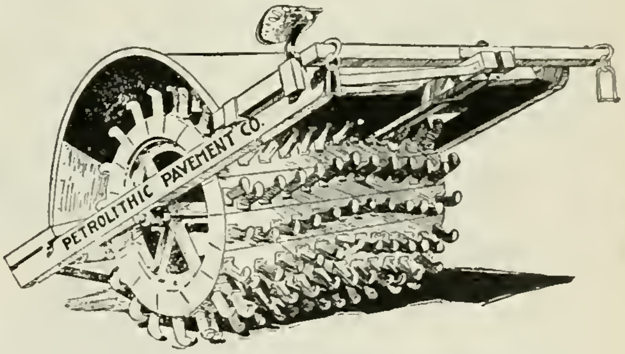
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Concrete Work—(See Contractors; also Fireproof Construction)

Contractors
Eidenbel Construction Co.
Ferguson Contracting Co.
Jackson, Inc., Geo. W.
Lucius Engrg. & Contrtg. Co.
Rodgers Co.
Trussed Concrete Steel Co.

Contractors' Supplies and Equipment — (See also Second-hand Supplies)
Bond Co., Harold L.
Contractors' Sup. & Equip. Co.
Curtis, C. B.
Interstate Equip't & Eng. Co.
Koppel Co., Arthur.
McKelvey Machinery Co.
Shaw, Willis.
Wiener Co., Ernst.

Converters and Cooling Towers
Graver Tank Works, Wm.

Conveyors and Conveying Machinery—(See Coal and Ore Handling and Conveying Machinery)

Couplings—Friction Clutch
Brown Hoisting Machy. Co.
Browning Engineering Co.

Cranes and Hoists
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Browning Engineering Co.
Hayward Co.
Ingersoll-Rand Co.
Ransome Concrete Machy. Co.

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Crossings—Railways (See Frogs)

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Bradley Pulverizer Co.
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Browning Engineering Co.
Carson Trench Machine Co.
Contractors' Sup. & Equip. Co.
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Lidgerwood Mfg. Co.
Terry & Tench Co.

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Carson Trench Machine Co.
Brown Hoisting Mach. Co.
Browning Machinery Co.
Fairbanks Steam Shovel Co.
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Ingersoll-Rand Co.
Lidgerwood Mfg. Co.
Municipal Eng & Contrg. Co.
Thew Automatic Shovel Co.
Souther & Co., John.
Vulcan Iron Works.

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Drawing Tables — (See Engineers' Supplies)

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Marine Engine & Machine Co.

Employment Agencies
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Engineering Agency.
Graham, J. F.
Hapgoods.
Int. Bro. of S. S. & D'men.
Int. Immigration Bureau.
Labor Office for Italians.

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Weber Gas Engine Co.

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Lidgerwood Mfg. Co.
Mietz, August.
Stroudsburg Engine Works.

Engines—Stationary and Pumping
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Deane Steam Pump Co.
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Stroudsburg Engine Works.

Engines—Traction
Huber Mfg. Co.

Expanded Metal—(See Fireproof Construction Co.)

Excavating Machinery — (See Ditching Machinery)

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Conard, W. R.

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Davenport Locomotive Wks
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Haines Concrete Mixer Co.
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Edson Manufacturing Co.

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Pumps—Windmill
Cook Well Co.

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Koppel Co., Arthur.
Oliver Mfg. Co., Wm. J.
Wiener Co., Ernst.

Rails—Relaying
Ridgely & Co., Chas. A.
Shaw, Willis.

Railway Track Specialties and Equipment
Blome Co., R. S.
Koppel Co., Arthur.
Wiener Co., Ernst.

Railways—Industrial (See Industrial Railways)

Reinforced Concrete Construction (See Fireroof Construction)

Riveters (See Pneumatic Tools, Etc.)

Road Machinery, Road Rollers.
Good Roads Machinery Co.
Indiana Road Machinery Co.
Kelly-Springfield R'd Roller Co.

Rock Crushers (See Crushers and Pulverizers)

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Graver Tank Works, Wm.

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Columbus Tent & Awning Co.

Test Borings (See Artesian Wells)

Tracks—Portable (See Railway Track Specialties and Equipment)

Traction Engines (See Engines—Traction)

Trench Machines and Supplies (See Ditching Machinery)

Turnbuckles
Clevel'd City Forge & Iron Co.
Merrill Bros.

Turntables
Chicago Bridge & Iron Works
Koppel Co., Arthur.
Vulcan Iron Works.
Wiener Co., Ernst.

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Norwood Engineering Co.

Wagons—Dump (See Carts and Wagons)

Waterproofing
Hausling Co., F. M.
Winslow Co., E. J.

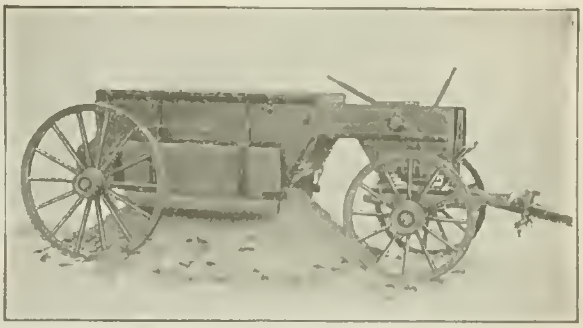
Waterworks Supplies
Bond Co., Harold L.
Cook Well Co.
Water-Works Equipment Co.

Well Drilling (See Artesian Wells)

Well Strainers
Cook Well Co.

Wire Rope and Aerial Tramways (See Cableways)

NATIONAL DUMP WAGON



Patent loop and bar hinges which cause doors to slide up outside of wagon box when load is dumped. This gives extra clearance so wagon can be built low and short.

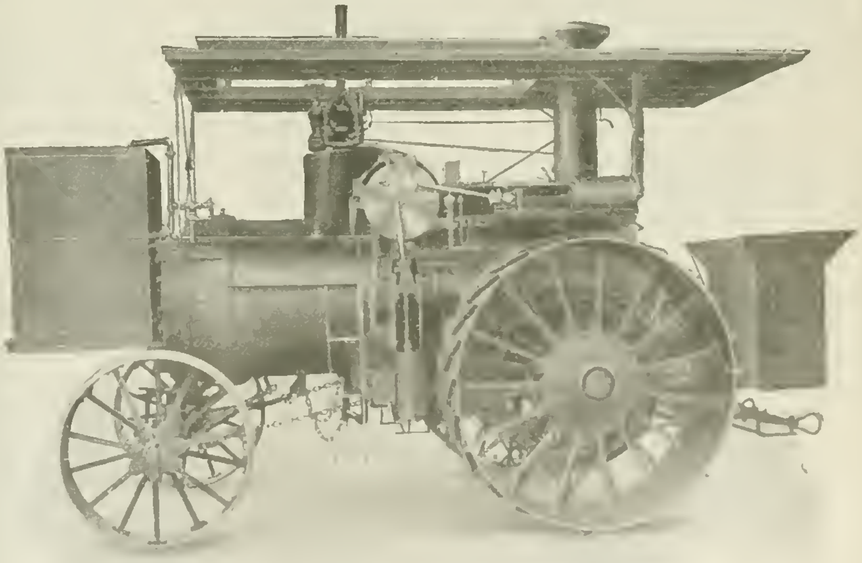
Matched hardwood boxes, sand tight steel doors, special goose neck re-enforcement and box trusses. Wood or steel axles. 1½ and 2 yds. capacity.

SEND FOR CATALOGUE E-C.

Indiana Road Machine Company
Fort Wayne, Indiana

The Traction Engine as a Pulling Power,

shown in the New Huber Contractor, is a proved success. The wide, high drive wheels and the high steel cleats enable the engine to get a grip on the ground that will stand an enormous pulling strain. No matter what twisting or side strain there may be, the driving mechanism can never get out of line. The cylinder, guides and bearing are cast in one piece and bored at one setting, insuring constant, perfect alignment.



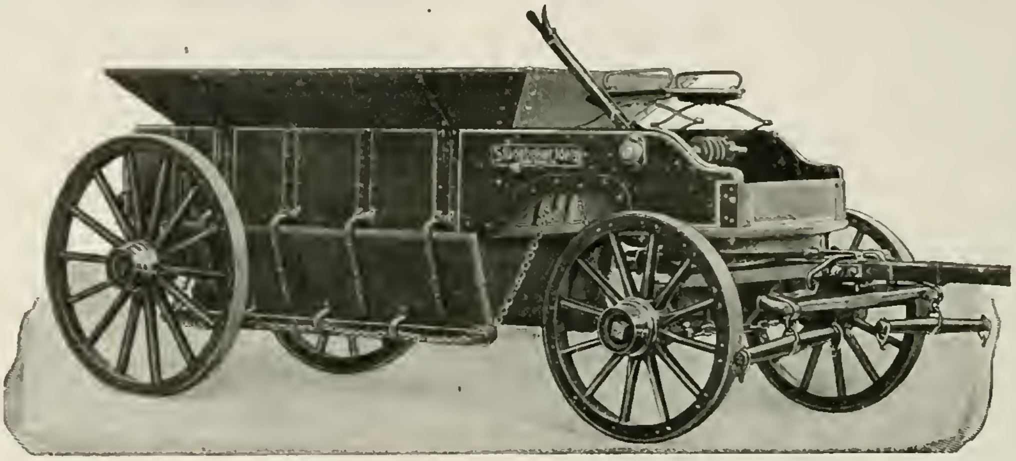
The Compensating Gear is composed of all-steel spur gear and pinions and is enclosed between two steel plates, keeping it free from sand and dust. The purpose of this device is to allow one drive wheel to revolve independently of the other when needed, and is thrown in and out by a foot lever from the platform.

Our boilers are high mounted, so that the engine will readily pass over obstructions that would stop the low hung style. The rear axle is in one piece and runs straight under the boiler. The pulling attachment is connected directly with this axle and will stand any pulling strain that the engine may be subjected to. The illustration here is of the Double Cylinder Engine. One crank is horizontal and the other perpendicular, both connected to the same wrist, and preventing any stopping on dead center. We make engines from 16 to 31 horse power, adapting them to every kind of contract work. Our special catalog gives full details. Ask for catalog No. 7.

THE HUBER MANUFACTURING CO., Marion, Ohio

Studebaker

Maximum Strength Combined with Lightness of Draft



The first requisite in a dump wagon is strength

The Studebaker Improved Ideal dump wagon is built to stand up under hard work. We use open hearth steel instead of Bessemer for reinforcements. Double reinforcements are used on the outside of neck and the reinforcement on the inside of the neck extends along its full length. Studebaker "slope shoulder" spokes, strongest where other spokes are weakest, are used in the the wheels. The wheel rims are riveted on each side of the spokes and the tires are bolted to the rims.

A dump wagon should have light draft

Studebaker wagons have long been famous for their easy running qualities. In addition to the perfect dish of the wheels and set of the axles, the Studebaker Improved Ideal has the advantage of an extremely short coupling. Our draft equalizer is also a distinct aid to lighter draft.

Be sure you get a dump wagon that will stand up under hard work

SEND FOR CATALOGUE

STUDEBAKER BROS. MANUFACTURING CO.

LARGEST VEHICLE MANUFACTURERS IN THE WORLD

SOUTH BEND, INDIANA, U. S. A.

PRACTICAL CEMENT TESTING

By W. PURVES TAYLOR, M. E., C. E.
Engineer in charge Philadelphia Municipal Testing Laboratories.

This is the first practical and exhaustive treatise on this important subject. It has already been adopted as a text book by the University of Pennsylvania and leading technical schools. Each chapter contains a minute description of the methods followed in the author's laboratory and many valuable suggestions as to the "how" and "why" of cement testing. The observations on the interpretation of results, one of the most difficult tasks of the novice, are especially pertinent and are expressed in a fair and conservative manner.

The book is so complete that it can be put in the hands of a young engineer with confidence that it will enable him to make reliable tests on cement. The wealth of photographs and line cuts furnish the pictorial examples of how to conduct cement tests, and the 300 pages of text are so explicit that even the most inexperienced man can soon learn the art of cement testing. Yet the book has not a superfluous paragraph The list of chapters includes: (1) Classification and Statistics, (2) Composition and Constitution, (3) Manufacture, ( ) Inspection and Sampling, (5) The Testing of Cement. (6) Specific Gravity, (7) Fineness, (8) Time of Setting. (9) Tensile Strength, (10) Soundness, (11) Chemical Analysis, (12) Special Tests, (13) Approximate Tests, (14) Practical Operation, (15) Other Varieties of Cement than Portland, (16) Specifications (The Author's Am. Soc. C. E., A. M Soc. Test: Mtls., Soc. Chem. Indust., Corps Eng. U. S. A. British Standard Can. Soc. C. E.)

Cloth, 6 x 9 Inches; 330 Pages; 112 Illustrations; 58 Tables; $3.00 Net, Postpaid.

THE MYRON C. CLARK PUBLISHING CO.
(Not Incorporated)
355 DEARBORN STREET CHICAGO

Cements, Mortars and Concretes- Their Physical Properties

An up-to-date Compendium of Reliable Tests of Cements, Mortars and Concretes

By MYRON S. FALK, Ph. D.

Instructor in Civil Engineering, Columbia University.

This book contains a very complete report of the results of tests made during the past fifteen years, and gives these results in tables and diagrams classified according to subjects. This is a reference book that should be in the library of every civil engineer. The contents include chapters on Chemical Properties of Cement, Physical Tests of Cement, General Physical Properties, Elastic Properties in general, Tensile Properties, Compressive Properties, Flexural Properties, Report on Uniform Tests of Cement by the Special Committee of the American Society of Civil Engineers and Constitution of Cement.

Cloth, 6x9 inches; 184 pages; illustrated: price $2.50 net, postpaid.

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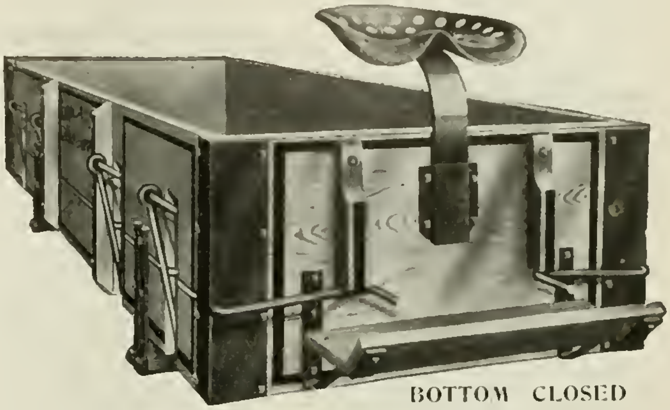
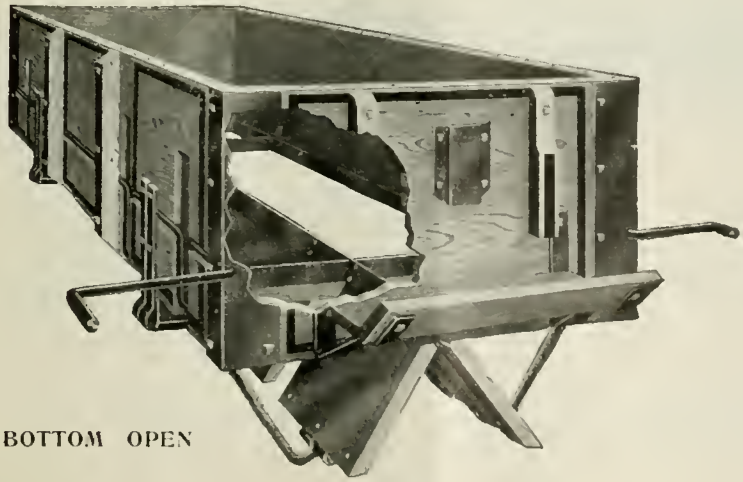
THE MYRON C. CLARK PUBLISHING CO., (Not Incorporated)
355 Dearborn Street, CHICAGO.

The Chicago Quick Dumper Reduces Draft on Team One-Half



BOTTOM CLOSED

THE Chicago Quick Dumper is a portable, bottom-dump wagon box that can be used on any wagon gear having a reach. This is not the whole story however—if it were we should not be telling it here. It is a portable, bottom-dump wagon box, made in sizes from one to five cubic yards capacity, which, by means of a special device for operating the bottom doors, distributes the load equally over the front and the rear wheels and allows the gear to be coupled up *as close as 65 inches.* These two facts, as every teamster knows, reduces the draft on the team—in some cases this reduction is over a half and in no case is it less than a quarter. This is a gain that means dollars and cents. It means dollars and cents too, to be able to remove the box and have the gear free for other purposes. And finally, it means more dollars and cents to get a sand-tight, high class dump wagon outfit at a quarter of the cost of a special dump wagon. Send for our Catalog No. 22 for a full description of the Chicago Quick Dumper and of how it saves money.

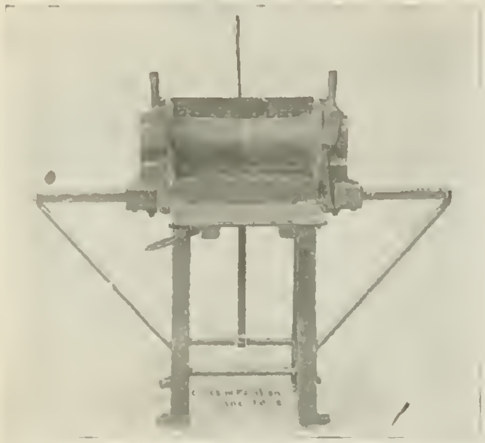


BOTTOM OPEN

BLACK MFG. CO.

130 East Ohio Street
CHICAGO, ILL.

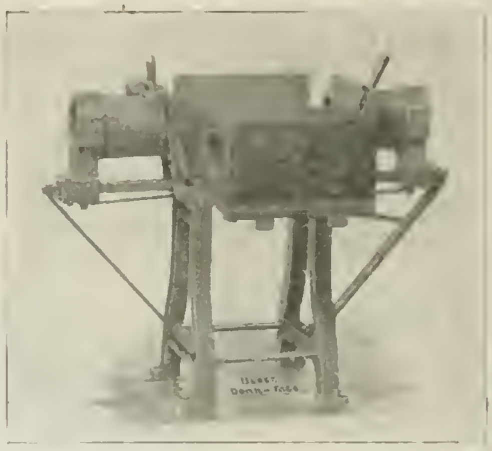
A Complete Block Plant for $100.



The **"RUNYAN, JR."**

is the **only** block machine having the arched longitudinal horizontal core; it is also the only block machine that will make a down-face and side-face block. 8 and 10-inch widths of blocks can be made on a 10-inch pallet, and this pallet can be either wood or iron.

The block made on this machine represents all that constitutes strength, adaptability and durability; it is constructed on the latest and most approved plans, and is endorsed by expert authority on building construction. It can be moulded with a core throughout its entire length, or it can be moulded partly cored and partly solid, in any design desired.



On account of the physical construction of this block, its uses are numerous and varied: buildings, foundations, porch columns, piers, chimneys, retaining walls, abutments, steel reinforcements, sewers, conduits, pneumatic tubes, etc., thus supplying a commodity not heretofore produced and for which there is an enormous demand. We introduce a simple method of laying these blocks in a wall, which practically converts it into a "cored monolithic construction," which will eventually supersede the more expensive and less efficacious "solid monolithic wall."

The block made on **"RUNYAN, JR.,"** with its arched longitudinal horizontal core is acknowledged the strongest and most practical concrete block ever invented. It is **stronger in every part** than the **vertical core** block, and is **strongest** where the latter is **weakest**, namely, at its central point.

It is undoubtedly the block of the future; scientifically constructed, easily and quickly laid, giving strength and durability to a wall not attained by any other kind of a block. Endorsed by architects, contractors, builders, government experts and the building public generally.

Our patents are already granted on the device shown in these cuts, which forestalls the invention of any device having similar features, and the public is warned against imitations and infringement accordingly

COMPLETE NEW FOLDER OF THE ***"RUNYAN, JR."*** *SENT UPON REQUEST.*

THE RUNYAN CONCRETE MACHINERY CO.

75-77 Canal Street, CLEVELAND, OHIO

The Troy Dump Wagon Tests

II—TESTING THE COMPLETE WAGON

We spoke last week of the Troy Wagon Test conducted by Prof. W K Hatt at the Purdue University Laboratories In fact a series of tests was conducted; a complete wagon was tested and tests were also made of several separate Troy Wagon parts. The first test was that of a complete wagon taken from stock and rated to carry safely a load of 8.500 lbs. The wagon box was filled flush with sand and the wagon placed between the vertically moving jaws of a compression testing machine. The pressure of the machine came directly on the sand, it did not touch the sides of the body, so that the load went down to the bottom of the box through the sand except for such parts as went directly into the sides through the friction of the sand At a load of 72.500 lbs. the wagon failed by

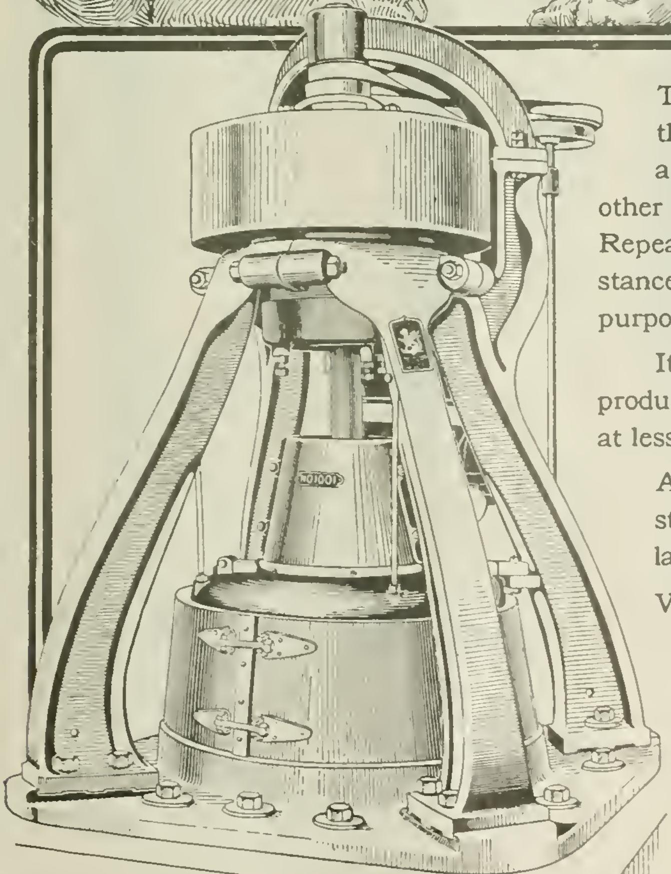
the shearing of the rivets joining the steel neck plates to the side boards. The rated load for the wagon was 4¼ tons; it sustained a load of 36¼ tons or over 8½ times the rated load before breaking Then the body failed, the wheels, axles and bolsters showed no signs of failure; the springs over the rear axle showed no signs of failure; the chains were intact; the dumping mechanism worked after the test and dumped the load; **the bottom of the box had sagged 4.37 inches but did not leak sand under the test.** These are the summarized figures of the test; they are given in detail in our pamphlet describing the test, which will be sent free on request In our next advertisement we shall describe one of the wheel tests Send for Catalogue No 2-E and full report of tests

THE TROY WAGON WORKS COMPANY

295 S. Walnut Street, TROY, OHIO

THE PERFECT PULVERIZER

THE GRIFFIN MILL



The long, continuous and successful use of the Griffin Mill for pulverizing Cement Rock and Clinker, Coal, Phosphate Rock and all other refractory substances proves its worth. Repeatedly tested under the most adverse circumstances it never fails to accomplish the desired purpose.

It is being used the world around and invariably produces a larger product of more uniform fineness at less cost than any other mill.

All we ask is an opportunity to prove these statements to you by the evidence of the largest manufacturers.

Write to-day for facts.

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KAHN SYSTEM

LIMA LOCOMOTIVE & MACHINE CO.'S OFFICE, LIMA, OHIO

This seven-story office building is built throughout according to the Kahn System o Reinforced Concrete. Footings, columns, basement walls, beams, and stairs are all concrete. Floors and roof are Kahn Type of Concrete reinforced with Kahn Trussed Bars Entire monolithic frame veneered with stone and pressed brick. An ideal office building nside and out. Write for copy 'Mills and Foundries."

We originate and manufacture material, including the patented Kahn Trussed Bar, Kahn Expanded Bar, Cup Bar, and Kahn Metal Lath, to meet every requirement of **Reinforced Concrete Construction.**

The **Kahn System** is a method of building based on organized engineering skill, experience and facilities for handling reinforced concrete construction in the most efficient and economical way.

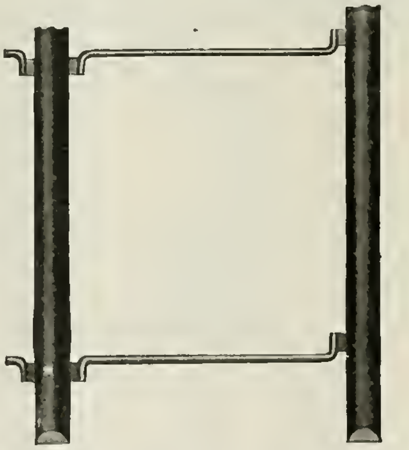
We co-operate fully with architects, engineers and contractors in planning this class of work.

Kahn Rib Metal

(Patented)

A series of laterally constructed bars carrying [the load directly to the supports.

Rigidly attached members Straight line action
No waste Material Every ounce where most needed

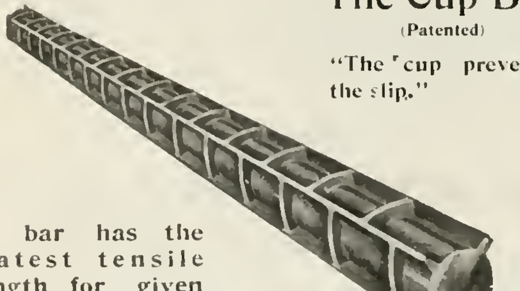


Showing a single mesh of No. 6 Standard Kahn Expanded Bars, reduced to 1-3 size.

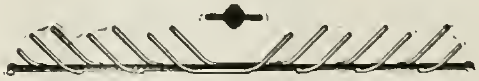
The Cup Bar

(Patented)

"The 'cup prevents the slip."



This bar has the greatest tensile strength for given weight of metal of any deformed bar.



Kahn Trussed Bar

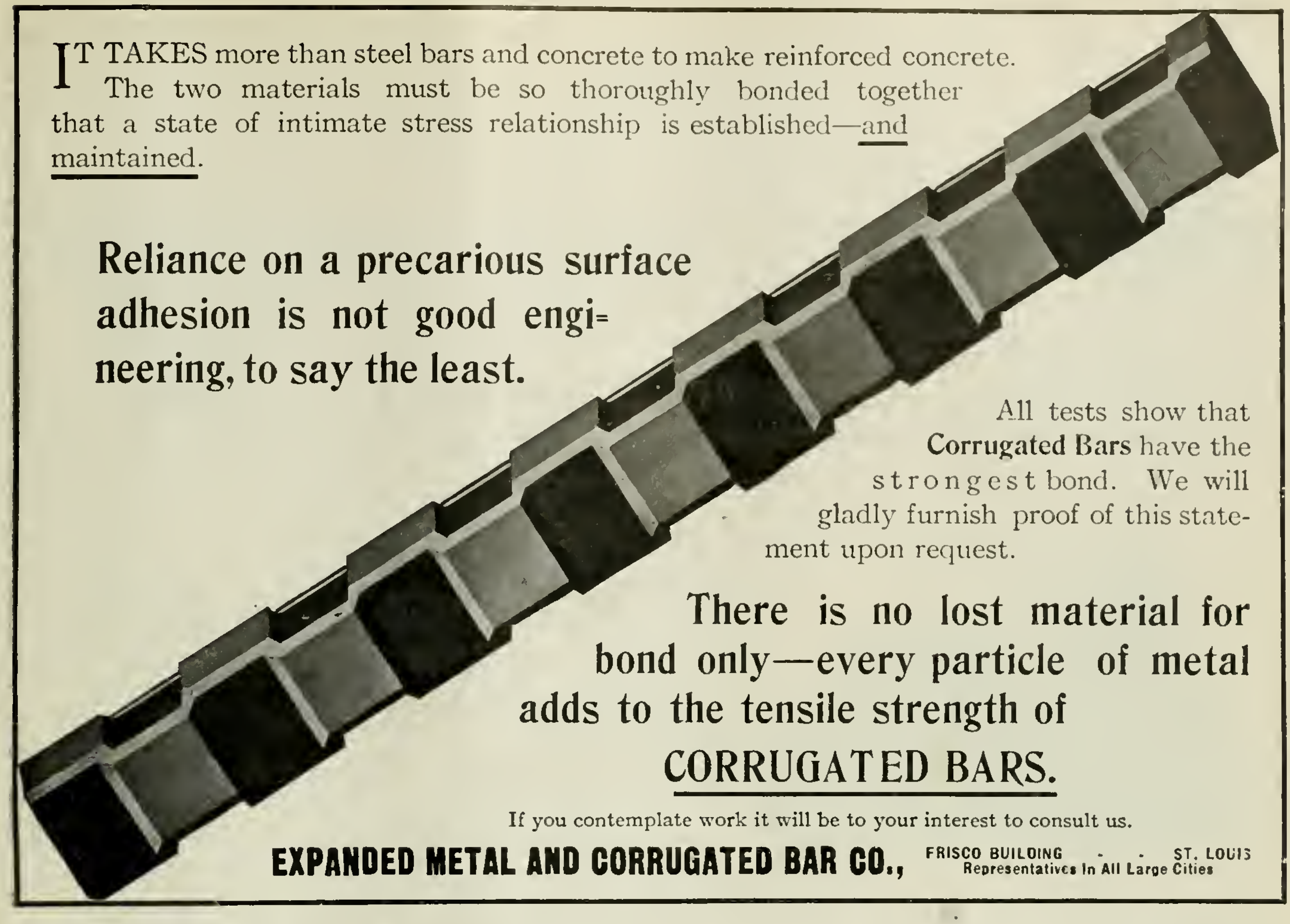
(Patented)

The best material for reinforcing Concrete where subjected to sheer stresses.

Write and let us show you how you can use reinforced concrete.

TRUSSED CONCRETE STEEL CO.

LONDON 49 Congress St., **DETROIT** **TORONTO**



IT TAKES more than steel bars and concrete to make reinforced concrete. The two materials must be so thoroughly bonded together that a state of intimate stress relationship is established—and maintained.

Reliance on a precarious surface adhesion is not good engineering, to say the least.

All tests show that **Corrugated Bars** have the strongest bond. We will gladly furnish proof of this statement upon request.

There is no lost material for bond only—every particle of metal adds to the tensile strength of

CORRUGATED BARS.

If you contemplate work it will be to your interest to consult us.

EXPANDED METAL AND CORRUGATED BAR CO., FRISCO BUILDING - - ST. LOUIS
Representatives In All Large Cities

"ANTI-HYDRO"
A Liquid
For
Cement
Waterproofing

The Hausling System

A Process for rendering Masonry of all kinds Water, Frost, Gas and Moisture Proof by Cement Coatings made impervious with "ANTI-HYDRO"

The Only
"Positive and Permanent"
Waterproofing

F. M. HAUSLING CO.
No. 403 West 59th St.
NEW YORK

High Elastic Limit—Ductility

"HUDSON"
STEEL BAR
For Reinforcing Concrete

Sizes: Round Square and Twisted, $\frac{5}{16}''$ to $1\frac{1}{4}''$

Manufactured by
THE ROGERS-SHEAR CO.
Warren, Pa.

Cut to Lengths——Immediate Shipment Guaranteed

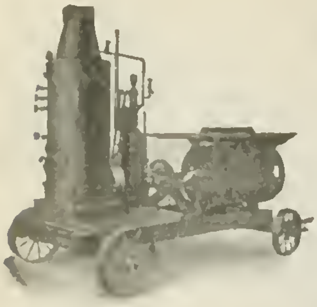
HUDSON STRUCTURAL STEEL CO., Southern Boulevard, N. Y.

Reinforcement for Concrete Work

Twisted Steel Cold Twisted Lug Bar
Pin Connected Frame Reinforcement

Bars Carried in Boston Stock
or Shipment from Mill

Aberthaw Construction Co.
Beacon Street, BOSTON, MASS.



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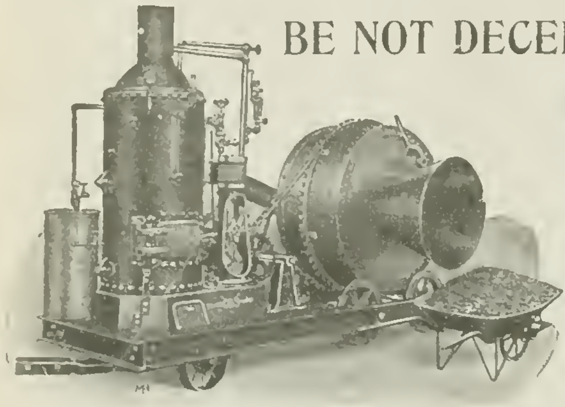

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Cost Keeping Not a Complex Process

We give space in this issue to an article by Magee Fisher, on cost keeping. This article is deserving of mention for the forcible manner in which it makes the contention that cost keeping on engineering work is not necessarily a complex process. The fear that he will involve himself in a complicated and expensive system of special bookkeeping has without doubt kept many a contractor from taking up a cost keeping system who would otherwise have done so. Mr. Fisher, however, stops at the proof that cost keeping is not a complex task if it is gone about in a common sense manner. As we have pointed out many times, cost keeping, that is, the mere task of ascertaining what the unit costs of a piece of engineering work are, is only one feature of cost keeping in the broad application. A cost keeping system should be, if it is to be of the greatest value, a means of keeping track of the efficiency of labor. While it is wholly desirable that a contractor should know in detail what a piece of work has cost him, it is far more desirable that he should be able to tell from day to day whether his men are working up to their full efficiency. In a word, cost keeping as applied to engineering work is a direct means for learning the better management of men. It is from this point of view that we recommend that our readers study the paper "Cost Keeping as an Aid in Managing Men," published in our issue of July 17 in connection with the paper by Mr. Fisher published in this issue.

Tests of Cold-Twisted Steel Rods for Concrete Reinforcement.*

BY JESSE J. SHUMAN.†

After several years' experience with the manufacture of cold-twisted steel bars for concrete reinforcement the writer feels that there is not enough definite information on the subject. These notes are published in the hope that they may help engineers to write "safe and sane" specifications to govern the quality of an important material of construction. They may also be of value to those who are called upon to decide on the relative merits of the numerous styles of concrete bars.

Number of Turns.—The momement the twisting machine has created a permanent set in the fiber, the steel has begun to increase in strength, in the same manner as higher yield-point and ultimate strength are set up in a bar when it is slightly stretched in a testing machine. As the twisting proceeds the yield-point ascends more rapidly than the ultimate strength. There is a point, however, at which the maximum strength of the bar is reached, and beyond which it is reduced somewhat before the bar twists apart.

The interesting behavior of half-inch squares of three widely different grades is shown in Table 1. It would clearly be a mistake to specify a number of turns approaching the maximum strength of the steel, for the internal strains in such a bar are already nearly enough to destroy it; yet it is not uncommon for engineers to do this very thing. In the writer's opinion the number of turns should be about half the number at which the steel is at its maximum strength, and in the ordinary soft Bessemer product this means one complete twist in 8 to 10 times the size of the bar; in other words the pitch of the twist should be 8 to 10 for Bessemer steel of about 60,000 lbs. tensile strength. Basic open-hearth squares of similar grade should have a pitch of 5 to 7 in order to have their best properties developed. If carbons higher than ordinary structural grades are insisted upon, a proportionate concession must be made in the number of twists.

Table I.—Experiments With ½-in. Twisted Squares, Showing the Effect of Increasing Number of Twists.

		Yield-point. —Lbs. per sq. in.—			Ultimate Strength. Lbs. per sq. in.—		
Grade.	No. of Turns per Foot.	Plain.	Twisted.	Increase Per cent.	Plain.	Twisted.	Increase Per cent.
Soft Bess.	3	41,600	65,600	57.7	60,400	83,200	37.7
"	4¾	39,200	72,400	84.7	60,000	89,600	49.3
"	5	41,600	84,800	103.8	60,800	92,000	51.3
"	5¾	40,800	84,000	106.9	60,400	90,000	49.0
"	5⅞	40,000	80,800	102.0	60,800	88,800	46.0
Bess. .25	3	48,800	83,600	71.3	74,000	96,000	29.7
Carb.	4½	51,200	83,200	62.5	75,200	99,200	31.9
"	4⅞	52,800	88,800	68.2	75,200	104,000	38.3
"	5	51,200	84,200	64.4	75,600	102,000	34.9
"	5½	53,200	84,200	58.3	75,200	100,800	34.0
Soft O.H.	3	31,200	46,000	47.4	46,400	64,000	37.9
"	5	31,200	60,800	94.9	47,200	68,000	44.1
"	7	31,200	68,800	120.5	46,000	76,000	65.2
"	9	31,200	67,200	115.4	47,200	71,200	50.8

Table II.—Tests on Plain and Cold-Twisted Steel Bars, Soft Bessemer Steel. Number of Turns, Ordinary.

		Yield-point. —Lbs. per sq. in.—			Ultimate Strength. —Lbs. per sq. in.—		
Size. Inches.	No. of Turns per Foot.	Plain.	Twisted.	Increase, Per cent.	Plain.	Twisted.	Increase. Per cent.
¼x¼	4	36,800	80,000	117.4	65,600	92,800	41.5
"	4	38,400	78,400	104.2	68,800	91,200	32.5
½x½	3	41,600	65,600	57.7	60,400	83,200	37.7
"	3	38,600	66,000	71.0	63,100	91,200	44.5
¾x¾	1½	40,340	74,680	85.1	60,450	80,860	33.8
"	1½	39,120	72,720	85.9	60,080	81,060	34.9
1x1	1	36,000	66,000	83.3	61,000	73,900	24.4
"	1	37,400	67,500	80.5	61,000	74,000	21.3
1¼x1¼	¾	39,530	61,100	54.5	61,420	78,950	28.5
"	¾	38,251	62,510	63.4	61,300	79,270	29.3

Quality.—Excellent results have been obtained with both Bessemer and open-hearth steels of a wide range of carbons. It seems reasonable, however, that the grades that have been found to be best adapted to structural work would also be most reliable for reinforced concrete. Bessemer steel containing carbons up to 0.30 or 0.40 per cent can be twisted successfully, and are very high in tensile properties, but they have the same brittleness that constitutes the strongest argument against the various hot-rolled and hot-twisted concrete bars. The latter must be high in carbon in order to yield an elastic limit that even approaches that of the soft steel cold-twisted square rods. Surely the lowest yield point in Table II, in which are shown results on soft Bessemer bars, is high enough to suit the most exacting requirements.

On low-phosphorus steel the effect of twisting is not as marked as on Bessemer steel, the behavior in this respect being quite similar to that of the same steel when cold-rolled or cold-drawn. The lower results are readily raised, however, by carry-

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*Paper read before American Society for Testing Materials, Atlantic City, June 22, 1907.

†Chief Inspector, Testing Department, Jones & Laughlin Steel Co., Pittsburg, Pa.

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ing the twisting process further. Table III shows what can be expected of basic open-heath bars of 55,000 to 65,000 lbs. tensile strength twisted an appropriate number of turns.

Manifestly it would be a poor plan to use open-hearth steel softer than the tests shown in this table, but it would be both safe and advantageous to use steel up to about 0.35 per cent carbon, with phosphorus under 0.04 per cent.

Elastic Limit.—Inasmuch as the function of a reinforcing bar is performed inside the elastic limit, the elastic limit is the feature of highest importance from the engineer's standpoint. It is here that the cold-twisted square excels all hot-finished sections and must always continue to do so, for its elastic limit of 60, 70 and even 80 thousand pounds permits the use of less steel for the same service than can be guaranteed by its competitors.

Table III.—Tests on Plain and Cold-Twisted Steel Bars, Open-Hearth of 55-65,000 Lbs. Tensite Strength

Number of Turns, Special.

		Yield-point. —Lbs. per sq. in.—			Ultimate Strength. —Lbs. per sq. in.—		
Size. Inches.	No. of Turns per Foot.	Plain.	Twisted.	Increase Per cent.	Plain.	Twisted.	Increase. Per cent.
½x½	5	38,000	58,000	52.6	61,200	92,000	50.3
"	5	37,600	60,000	59.6	60,400	91,200	51.0
¾x¾	2½	31,170	52,800	69.4	57,020	69,670	22.2
"	2⅓	34,370	55,770	62.3	57,050	69,300	21.5
1x1	1¾	33,120	57,920	74.9	57,430	67,480	17.6
"	1¾	33,360	54,350	62.9	59,060	72,300	22.4
1¼x1¼	1½	33,740	62,230	84.4	55,550	68,890	24.0
"	1⅓	32,950	57,140	73.4	55,810	73,340	31.4

In the testing laboratory it is necessary to take unusual pains to observe the yield-point, commonly called elastic limit, for the reason that the beam of the machine does not always drop when the point is reached at which permanent deformation begins. The machine should be run not faster than ⅝-in. per minute, and in the absence of an autographic device a pair of dividers should be held on the specimen until the yield-point is observed.

Proposed Specifications for Cold-twisted Rods.—Specifications for cold-twisted bars should be consistent with the behavior of steel of known quality, and should recognize the empirical laws peculiar to the material. Thus, to summarize and add to points made in this paper, the following suggestions are offered as a broad foundation for specifications.

1. Process. Specify whether open-hearth steel should contain less than 4.04 per cent phosphorus for basic and 0.06 per cent for acid steel.

2. Carbon. This should usually be left to the discretion of the manufacturer, who insists that when carbon limits are named the tensile requirements should be left open.

3. Elastic Limit. For squares ½-in. and smaller, this should be at least 65,000 lbs.; for squares ⅝-in. to 1 in. at least 60,000 lbs., and for squares 1⅛-in. and larger at least 55,000 lbs. Manufacturers can generally guarantee minima values somewhat higher than these, but the above would be a reasonable specification.

4. Ultimate Strength. To be recorded.

5. Elongation. At least 5 per cent in 8 ins. or 12 per cent in 2 ins.

6. Reduction of Area. To be recorded.

7. Bend. Bars to bend cold around a pin twice their size without distress.

8. Number of Turns. For Bessemer steel, one complete turn in 8 to 10 times the size of the square; for open-hearth steel, in 5 to 7 times the size.

9. Number of Test Pieces. One tension-test specimen and one for bending test for each melt used in each size.

10. Inspection. All tests governing the acceptance of material to be made at manufacturer's works. Inspector to have access to the bars prior to shipment, but the manufacturer is not relieved thereby from responsibility for unsatisfactory material. In this connection it may be stated that each bar is thoroughly cleaned by the twisting process, and that each piece is in a large measure tested at the same time, as no imperfect bar will stand the cold-twisting process.

Cost of Lining a 1,000 Ft. Railway Tunnel.

In our issue of July 17 we gave the cost of lining a single track tunnel with concrete. We give herewith similar data for comparative purposes, as several of our readers have asked whether the previously given figures did not represent an abnormally low cost, and, in subsequent issues, we shall give still more on the same subject.

This tunnel was lined with concrete side walls and a brick arch, the length of the lining being about 1,000 lin. ft. The two concrete side walls averaged 3.2 cu. yds. per lin. ft. of tunnel, and the cost was as follows per cu. yd.

		Per Cu. Yd.
1.1 bbl. cement at	$2.00	$2.20
0.9 cu. yd. stone at	0.60	0.54
0.5 cu. yd. sand at	0.12	0.06
Tools		0.04
Light		0.01
Falsework, timber and iron		0.07
Labor excavating for and building side walls		1.75
Engineering and supt		0.15
Work train service		0.90
Total		$5.75

Laborers received $2.00 a day on the concrete work. We are unable to give the cost of the labor in as much detail as was given in our issue of July 17, but the total cost per cubic yard is nearly the same in both cases. The cost of the sand was merely the cost of loading. Work train service (90 cts. per cu. yd. of concrete) covers the cost of hauling sand and broken stone.

There were four rings of brick in the arch which averaged 1.8 cu. yds. per lin. ft. of tunnel. The brick measures 2⅛x3⅞x8 ins. The cost of the brick arch was as follows per cu. yd.

		Per Cu. Yd.
Materials:		
1.1 bbls. cement at	$2.00	$2.20
480 brick at	7.00	3.36
0.4 cu. yds. sand at	0.50	0.20
Total		$5.76
Labor: Excavating and Preparing for Arching and Moving Centers:		
0.03 day foreman at	$4.00	$0.12
0.06 day foreman at	3.50	0.21
0.01 day timekeeper at	2.50	0.03
0.02 day blacksmith at	2.50	0.05
0.27 day laborer at	2.00	0.54
0.39 day at	$2.44	$0.95
Mixing Mortar and Building Brick Arch:		
0.03 day foreman at	$4.00	$0.12
0.06 day foreman at	3.50	0.21
0.01 day timekeeper at	2.50	0.03
0.05 day brick mason at	3.50	0.18
0.23 day brick mason at	3.00	0.69
0.35 day laborer at	2.00	0.70
0.73 day at	$2.65	$1.93
Quarrying Rock For and Filling Over Arch:		
0.07 day at $2.15		$0.28
Engineering and supt		0.16
Work train service		0.56
Falsework, timber and iron		0.07
Tools, light, etc		0.05

Summary of Brick Arch:

	Per Cu. Yd.
Materials	5.76
Labor, excavating, etc	0.95
Labor, mix mortar, etc	1.93
Quarrying rock and filling over arch	0.15
Engineering and supt	0.16
Work train service	0.56
False work	0.07
Tools, light, etc	0.05
	$9.63

Summary of Tunnel Lining:

	Per Lin. Ft.
3.2 cu. yd. concrete sidewalls at $5.72	$18.30
1.8 cu. yd. brick arch at $9.63	17.33
Total	$35.63

The two portals were of concrete and each contained 250 cu. yds. The average cost of each portal was as follows:

	Per Portal.
275 bbls. cement at $2.00	$5.50
225 cu. yds. rock at $0.60	1.35
110 cu. yds. sand at $0.12	0.13
Work train service	1.50
Lumber for forms	0.70
Labor, erecting and removing forms	1.40
Labor excavating for and building portals	5.00
Engineering and supt	0.50
Total	$16.08

This is equivalent to $6.45 per cu. yd. of concrete in the portals. The cost of two portals, $32.16, distributed over a tunnel 1,000 ft. long, adds $3.22 per lin. ft. to the cost of the masonry lining.

For a more extended discussion of the cost of tunnel lining the reader is referred to our issue of July 17. In a subsequent issue the cost of lining a very long tunnel will be given.

Port Elizabeth, South Africa, has decided to undertake a large water-borne drainage scheme. A total amount of $2,680,000 is to be expended on the undertaking.

A Simple System of Keeping and Recording Engineering Costs.*

BY MAGEE FISHER.

The complication of estimating and cost keeping has been unduly exaggerated, and cost-keeping especially is apt to be confusing to the young engineer making his debut into the business world. He is confronted by a vast array of systems and loose-leaf devices put forth by concerns more interested in the sale of their particular stationery than the welfare of their customer. Authors, too, who have written on the subject seem to take delight in rendering it as complex as possible; and bookkeepers and business men generally deem their own special methods as too sacred to be profaned by the uninitiated. The costs of the most complicated operation that was ever undertaken can just as readily be kept in a 10c time-book and in a ledger composed of sheets of blank paper as in a $10 outfit. But before entering on the field of accounting the engineer should take a thorough lesson in estimating and allow for it about fivefold the time he thinks will be required.

No purchases to be entered on this page except those chargeable to

Operation of Dredge.

Purchases entered by John Smith.

Date 1905	Items.	Check Nos.	By Check.	In Curr'cy.	On Acc't.	Ledger Transfs.
Oct. 16	Nissen & Jacobson, 12 yds. oilcloth.....			$3.80		
18	Standard Oil Co., 5 gallons cylinder oil...			3.88		
18	E. N. Woodbury & Co., gaskets..			.78		
20	Lamb Auto Co., acetylene....... ...			2.00		
21	Smith & Sons, carload coal, No. 13347....				$78 40	
Total....	Week ending October 21, 1905...			$10.46	$78.40	

No time to be entered on this page except that chargeable to

Operation of Dredge and Maintenance of same.

Time kept by John Smith. Week ending October 21, 1905.

Initial.	Name.	Charge to.	S.	M.	T.	W.	T.	F.	S.	Hours Operation	Hours Maintenance	Rate.	Amount Operation.	Amount Maintenance.
Roy	Long, foreman, night.........	Operation...	5	10	10	10	10	10	15	70		30	$21.00	
Henry	Steffensen, foreman, day......	Op.........		10½	11½	11½	11½	11½	10½	67		30	20 10	
Burt	Shaw, engineer, day..	Op.........	10	10	11	11	11	11	10	74		20	14 80	
John	Scott, day..................	Maintenance			10	10	10	10	10		50	17½		$8 75
do	do	Maintenance	10	10						20		do	3 50	
Harry	Thompson, day..............	Op.........		10½	10½	10½	10½	10½	9	61½		17½	10 76	
Arthur	Dawley, fireman, night.......	Op.........		10½	10½	10½	10½	10½	9	61½		17½	10 76	
Harry	Breher, day.................	Maintenance			10	10	10	10	10		50	17½		8.75
do	do	Op.........		10						10		do	1 75	
Ed	McCaul, day.................	Op.........		10½	10½	10½	10½	10½	9	61½		17½	10 76	
James	Clarke, engineer, night.......	Op.........		11½	11½	11½	11½	11½	11½	80½		30	24.30	
Ernest	Douglas, fireman, night......	Op.........		12½	12½	12½	12½	12½	14½	89		20	17.80	
J. W.	Duncan, night...............	Op.........		11½	11½	11½		5½		51		17½	9.00	
										646	100		$145.53	$17 50
	Shifts..............................			2	2	2	2	2	2	12				
	Hours actually running, day shift..........			4	9	5	8	8	7	41				
	Hours actually running, night shift........													
	Day finished up No. 13347 and No. 768			6	9	4	6	7	7	39				
	cars coal..........................			—	—	—	—	—	—	—				
	State of weather, day.................			Fair	Fair	Cloudy	Rainy	Fair	Fair					
	State of weather, night...............			Fair	Fair	Rainy	Fair	Cloudy	Fair					
	Cu. yds. earth moved..................			—	—	—	—	—	—	1200				

Accounts divide themselves into two classes: First, accounts of original entry, such as "time books" and "purchase books," in which employes' time and purchases of various sorts are entered when made; and, secondly, accounts of final entry, to which are copied the items previously recorded in the books of original entry; the accounts of final entry are known as the "ledger." If the accounts of original entry can be so arranged that only footings have to be copied to the "ledger" an immense amount of work and inaccuracy is thereby avoided.

Such an arrangement is doubly profitable, for it obliges the accountant to decide beforehand just what accounts he will and will not keep; then, having decided, it is a very simple matter to make all the original entries chargeable to any given account on a page by themselves; then at the end of the week only the sum total of the page need be copied to the ledger, and, if the loose-leaf system is used, all pages of original entry chargeable to that account, from the time book and purchase books, can be gathered together. But loose-leaf books have been a constant source of bother, the pages either tear out or some special kind of punching and paper have to be purchased. Fortunately, however, there have recently appeared for sale substantial clutch binders capable of holding unpunched paper of any

Ledger for Page 3.

Operation of Dredge.

This account opened at commencement of operation, July 15, 1905

Date 1905.	Items.	Tons of Coal.	Shifts Worked.	Man Hours.	Cu. Yards Moved.	Debits Cost. Labor.	 Cost Supplies.
	Forwarded.	58	144	10,085	13,781	$2,215.36	$1,209.15
Oct. 21	Pay roll for week Oct. 21.............		12	646	1,200	145.53	
21	Purchases, currency...						10.46
21	do on acct...						78.40
21	Cars of coal No. 13347—No. 768.........	32					
Footing—week ending Oct. 21.		90	156	10,731	14,981	$2,360.89	$1,298.01

---

*Extract from a paper published in the Cornell Civil Engineer for May, 1907.

Ledger for
Cost of Maintenance of Dredge.
Page 2.
This account opened at commencement of Building of Dredge, June 15, 1905.

Date 1905.	Items.			Days to Build.	Man Hours.	Debits.		Credits
						Cost Labor.	Cost Supplies.	
	Forwarded.				1,951	$436.22	$913.57	
Oct. 21	Pay roll for week ending Oct. 21				100	17.50		
21	Purchases, by check						101.17	
21	do currency						22.50	
21	do ledger transfers						30.00	
Footing	-week ending Oct. 21.	.		30	2,051	$453.72	$1,067.24	

kind and in such shape that the whole outfit may be handled as conveniently as a bound book.

Accounting is not an easy subject to write about intelligently, but the writer thinks that if any one interested will study the sample pages of accounts shown herewith he will be able to acquire the salient points. The illustration taken is the cost account of a dredging operation which the contractor not only wished to keep separate from his other operations going on at the same time, but to subdivide so as to ascertain separately the cost of setting up, of operating and of maintaining the plant.

For this purpose he decided on two accounts as sufficient, one entitled "operation" and one "cost and maintenance."

First, in the "purchase book" were entered all the purchases, which, for the benefit of the bookkeeper, were classified into "check," "currency," "account" and "ledger transfer" purchases. Secondly, in the "time book" were recorded the time of the employes, the state of the weather, the actual time operating, the progress of the work and other items of import. Then each week the sum totals were carried to the two ledger accounts, where all functions of the work could be analyzed week by week. Observe the separate columns for each function—one for coal burnt, one for shifts worked, one for man-hours, one for cubic yards moved, one for labor cost and one for material cost.

The contractor's confidential bookkeeper also week by week posted off from the "time" and "purchase" books all cash items to his cash book and all "accounts" and "ledger transfers" to their proper places in the "ledger," thus completing a balanced or so-called "double entry" ledger.

Then when the work of dredging was finally finished the contractor abstracted the cost for future reference as follows, thus completing his records:

(Abstract of Cost.)
Earthwork Dredge Operation. 1905.

Location— Mississippi Valley.
Nature and extent Railway embankment 2,000 feet long and 12 feet high. borrow pit along side and parallel with same
Material—Sand and silt of Yankee River Delta

Total yards moved	14,981
Shifts worked (ten-hour)	156
Cu. yards per shift	96
Total cost	$5179 86
Cost per yard—total.	34.6c.
do. —operation wages.	15.8
do. —operation coal	1.7
do. —operation repairs	7.0
do. — cost of plant wages.	3.0
do. —cost of plant material	7 1
Pounds of coal burned	180,000
Pounds per yard moved.	12
Average rate of wages per hour	22c.

Many engineers might find it convenient to keep similar cost abstracts of work valuable to them in a small card index, which would hold such records for a lifetime and yet never be bulky. It seems as though printed matter and other records accumulate so fast that the average individual is completely "swamped" and gains no benefit from his records, whereas, if the essential points were abstracted in compact form he could have them always at hand.

As illustrated above, the cost of any given piece of work is ascertained by adding together the various items, such as the cost of the labor, of the material, of the depreciation on the plant, of rent, of traveling expenses, etc. The amount of the work may be measured in units such as cubic yards of earth excavated, lineal feet of road built, or in per cents of completion, as in the case of a house where the architect specifies that it is 40 per cent completed.

If the contractor has spent 50 per cent of the money doing 40 per cent of the work, he is apt to have the cold shivers. As frequently happens, he does not discover this until the facts have become ancient history.

This is one wrong way of cost keeping. He might better have not kept any accounts at all, for what good were they?

I have taken a house as an illustration, but many of my readers can bring to mind some railroad or other large undertaking that has come to grief from the same cause. Too much stress cannot be laid on the importance of entering all items of expense instanter and in keeping the accounts up to date.

No purchases to be entered on this page except those chargeable to
Cost and Maintenance of Dredge.
Purchases entered by John Smith.

Date 1905	Items.	Check Nos.	By Check.	In Curr'cy.	On Acc't.	Ledger Transfs.
Oct. 16	American Steel & Wire Co., cable	201	$31.00			
17	Novelty Iron Works, bill to date	203	70.17			
17	From materials charged to Stock Acct. 2-7″ x 16″ x 32′ timbers					$30.00
20	Lamb Auto Co., acetylene lantern			$20.00		
21	Nevine Hardware Co., Crosby clamps			2.50		
Total	Week ending October 21, 1905		$101.17	$22.50		$30.00

Another wrong way of cost keeping is to keep too many cost accounts, the resulting work being so vast as to be a burden. Many persons fail to realize the amount of work involved in accounting; and this work is apt to be greatly increased unless the books are carefully checked and balanced at frequent intervals.

Estimating is almost the reverse of cost keeping. The work to be estimated is measured up into suitable units and tabulated. This is called "taking off." The estimated cost of each unit is then applied and the amount in dollars set out in the cost column. This is called "extending." This, then, is the engineer's estimated cost of the work to which the business department adds various amounts for overhead cost, profit, insurance against accidents, interest, etc. Many business men are said to add a liberal per cent for underestimating on the part of their engineer. Experience in paying the bills of underestimated work is a sure but costly road to accuracy in estimating.

Method and Cost of Mixing and Laying Bituminous Concrete for a Mill Floor.

In laying tar concrete base for wood covered mill floors, the common practice is to use a mixture of steam cinders aggregate and coal tar binder, and to mix the materials by hand. A departure from this practice is recorded by Mr. C. H. Chadsey, Construction Engineer, Northern Aluminum Co., Ltd., Shawinigan Falls, P. Q., Canada, in laying 17,784 sq. ft. of mill floor. A sand, broken stone and tar mixture was used and the mixing was done with a Ransome mixer. The apparatus used and the mode of procedure followed were as follows:

Two parallel 8-in. brick walls 26 ft. long were built 4 ft. apart and 2½ ft. high to form a furnace. On these walls at one end was set a 4x6x2 ft. steel plate tar heating tank. Next to this tank for a space of 4x8 ft. the walls were spanned between with steel plates. This area was used for heating sand. Another space of 4x8 ft. was covered with 1½ in. steel rods arranged to form a grid; this space was used for heating the broken stones. The grid proved especially efficient, as it permitted the hot air to pass up through the stones, while a small cleaning door at the ground allowed the screenings which dropped through the grid to be raked out and added to the mixture. A fire from barrel staves and refuse wood built under the tank end was sufficient to heat the tar, sand and stone.

For mixing the materials a Ransome mixer was selected for the reason that heat could be supplied to the exterior of the drum by building a wood fire underneath. This fire was maintained to prevent the mixture from adhering to the mixing blades, and it proved quite effective, though occasionally they would have to be cleaned with a chisel bar, particularly when this aggregate was not sufficiently heated before being admitted to the mixture. A little "dead oil" applied to the discharge chute and to the shovels, wheelbarrows and other tools effectually prevented the concrete from adhering to them.

The method of depositiing the concrete was practically the same as that used in laying cement sidewalks. Wood strips attached to stakes driven into the ground provided templates for gaging the thickness of the base and for leveling off the surface. The wood covering consisted of a layer of 2-in. planks, covered by matched hardwood flooring. In placing the planking, the base was covered with a ¼-in. layer of hot pitch, into which the planks were pressed immediately, the last plank laid being toe-nailed to the preceding plank just enough to keep the joint tight. After a few minutes the planks adhered so firmly to the base that they could be removed only with difficulty. The hardwood surface was put on in the usual manner.

The prices of materials and wages for the work were as follows:

Pitch, bulk, per lb.	$0.0075
Gravel per cu. yd.	1.50
Spruce sub-floor, per M. ft. B. M.	15.00
Hardwood surface, per M. ft. B. M.	33.00
Laborers per 10-hour day	1.50
Foreman, per 10-hour day	4.00
Carpenters, per 10-hour day	2.00

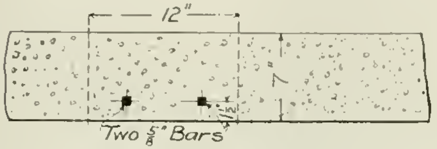
At these prices and not including a small administration cost or the cost of tools and plant, the cost of the floor consisting of 4½ ins. of concrete, 2 ins. of spruce sub-flooring and ⅞ in. hardwood finish was as follows per sq. ft.:

Pitch	$0.04
Gravel	0.02
Spruce, for sub-floor	0.03
Hardwood for surfacing	0.035
Labor, mixing	0.03
Labor, laying	0.015
Carpenter work	0.025
Total per sq. ft.	$0.195

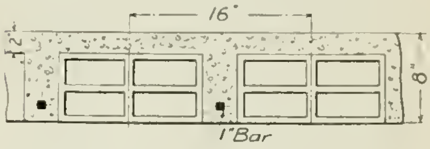
Economics of Reinforced Concrete. Floor Slabs.

A. E. BUDELL.*

As a result of close observation and careful preservation of cost data in a recent building operation, an interesting comparison was obtained between the actual cost respectively of the ordinary type of slab floor and what is commonly called the combination tile and beam system. Although the two floors mentioned were built to carry a light floor load of 50 lbs. per sq. ft., it will be easy to apply the results obtained to a more usual design in which the live loads will be taken at 100 lbs. per sq. ft. The labor on forms can be taken as the same in either case as an increase of 50 lbs. per sq. ft. will not change this item to any appreciable extent. All material and labor on concrete will be computed at the same unit prices that were obtained on the work. It might be said at this point that the above mentioned data can be applied with equal accuracy to any design with floor loads under 200 lbs. per sq. ft., since the cost of the floor will increase almost in direct ratio with the increase in material used. It is accordingly applicable to all floor work in apartment houses, warehouses and light machinery buildings.



Solid Slab Floor, Dead Weight 85 Lbs. Per Square Foot.



Combination Tile and Beam Floor, Dead Weight 50 Lbs. Per Square Foot.

A span of 12 ft. was used, as this is a common span met with in tile and beam construction, and is just twice the usual span met with in slab construction. This facilitates the comparison and approaches the conditions most generally experienced. As the actual observation were made on a slab with 12 ft. span I will first consider such a slab in my comparison and, later, show the economy in inserting an intermediary beam to reduce the span to 6 ft.

In the design of the slab the resistance of the concrete to tension was taken into consideration, as it undoubtedly performs an appreciable amount of work in such a case, and the comparison would not be true to the most economic design—compatible with safety—that can be employed in either case. In the case of the tile and beam design, however, the tensile resistance of the concrete was ignored as it should be in a concrete T section where there is a tendency to shear along the more or less imperfect joint usually caused by the later application of the top coating of concrete over the tile. Although these conditions of design favor the slab construction to some extent it is a fact that the combination tile and beam system can be built more cheaply than the former, within

Views of Combination Tile and Concrete Beam Work Under Construction.

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*95 Liberty St., New York.

the limits before mentioned, and this is shown in the collowing calculations:

The required thickness of slab for a span of 12 ft. and live load of 100 lbs. per sq. in. is easily determined by the common theory of fixure. Taking into account the conditions previously mentioned, we assume that the co-efficient of elasticity of concrete in tension equals one-half of the coefficient of elasticity of the same material in compression. By making use of the equations derived from the general expression

$$\int_{0}^{d} 2dA_1 - u\int_{h-d_1}^{0} 2dA_1 + \frac{E_2}{E_1}\int_{d_2-h_2^1}^{d_2} 2dA_2 = 0$$

(Prof. Burr's Resistance of Metals).

we obtain a required slab thickness of 7 ins. with 1.3 sq. in. of reinforcing steel per ft. of cross-section. By the same method we obtain a depth of floor equal to 8 ins. for tile and beam construction to carry the same loading over the same span.

As the dead weight of the tile and beam floor is 35 lbs. lighter per sq. ft. than that of the slab, the supporting girders can be made lighter.

We are now in a position to compare the costs of the two systems by the following:

Slabs—7 ins.

	Cost per sq. ft.	
Lumber—slab	$0.055	
Girders	.01	
Props	.02	
	$0.085	$0.085
Concrete—Slab	.11	
Girders	.03	
	.14	.14
Steel—Slab	.045	
Girders	.035	
	.08	.08
Labor—Forms	...	
Slab and girders	...	
Props	...	.09
Labor—Concrete	...	
Slab	.044	
Girders	.013	
	.057	.057
Total		$0.452

Tile and Beam—8 ins.

	Cost per sq. ft.	
Lumber—slab	$0.035	
Beam	.01	
Props	.015	
	.06	.06
Concrete—Slab	.05	
Beam	.025	
	.075	.075
Steel—Slab	.035	
Girders	.035	
	.07	.07
Tile—6 in. in place	...	.055
Labor—Forms, slab, including beams and props	...	065
Labor—Concrete, slab	.05	
Girders	.008	
	.058	.058
Total		$0.383

This shows quite a difference in favor of the tile and beam construction. If now, however, we insert an intermediary beam in the case of the slab, as explained previously, we can cut down this difference to a certain extent. The cost of such an arrangement follows. In this case we should only require a slab 4 ins. thick, with steel amounting to 6 sq. ins. per ft. of cross-section. Girders would be reduced in size individually, but would contain about one-third more material:

Slabs With Intermediary Beam.

	Cost per sq. ft.	
Lumber—		
Slab	$0.055	
Girders	.015	
Props	.02	
	.09	$0.09
Concrete—		
Slab	.06	
Girders	.04	
	.10	.10
Steel—		
Slab	.025	
Girders	.045	
	.07	.07
Labor—Forms		
Slab and girders	.125	.125
Labor—Concrete		
Slab	.03	
Girders	.02	
	.05	.05
Total		$0.435

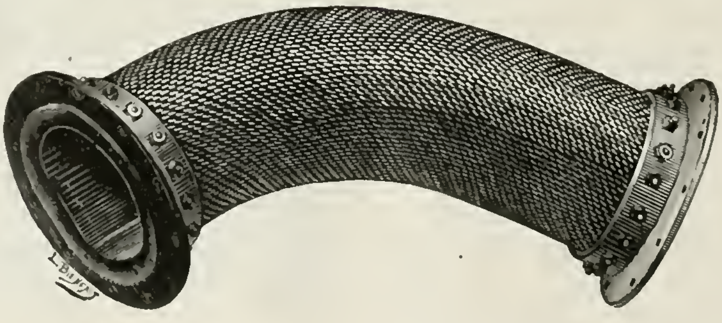
Hence, with all the assumptions in favor of the slab construction we still have an appreciable saving in the combination tile and beam system. In slab design the tensile resistance of concrete is very often ignored, and this would throw the balance still more in favor of the other system. There is, also a greater salvage of lumber in the tile and beam construction, in fact the centering can be used over and over, as there is practically no fitting or nailing necessary.

An Improved Sleeve for Dredge Delivery Pipes.

In hydraulic dredge work the delivery of the dredged material to the dumping ground is made. Through coupled lengths of steel pipe carried on floats on the water and laid along the ground on land. Flexibility is a necessary requisite of this delivery pipe since it must accommodate itself to the irregularities of the ground and the movements of the dredge and floats. To secure this flexibility various styles of flexible couplings have been devised. At first, short lengths of plain leather hose called "Dutch sleeves" were used. But owing partly to rapid wear and tear of their exterior surfaces produced by impact and abrasion against the ground (for such sleeves are in constant vibratory motion following the variations of stream pressure when in use), and particularly owing to the high internal pressure and the wear produced by the dredgings, these sleeves were found to give out very quickly. The weaker parts of the leather bulged out under pressure, forming pockets for gravel and detritus, which churning about under the stream action, soon wore holes through the sleeve walls.

To overcome these defects, articulated metal couplings were used forming regular knee joints, with cupped female and spherical male connecting pieces, similar to the universal ball and socket joints of flexible shafts. While very satisfactory for delivering water, these couplings were found excedingly troublesome when the dredgings contained any sand, gravel or detritus, as these materials lodged between the bearing surface, impeding all articulate action. Thus the flexibly jointed pipe line would become rigid, resulting in broken flanges or flange bolts, destroying the continuity of the delivery line.

In the pipe above illustrated in the accompanying cut the faults of both the ordinary leather sleeve and of the ball and socket joint are claimed to be overcome by returning to the principle of the leather sleeve and armoring it against wear. As is indicated by protecting and strengthening the leather or rubber sleeve by means of an articulated coating of galvanized steel wires of rather heavy gage, external wear and impact are resisted while strength is given to the sleeve to withstand the pressures occurring in practice, and to prevent the bulging or pocket-forming action which had proved so disastrous to the unprotected leather sleeves. The interlinked or plaited wire covering is similar to the ancient coats of chain mail, except that the links here do not permit movement in all directions, having only longitudinal play or freedom of motion in the direction of the pipe line's extension. This gives the armor sufficient flexibility to enable it to follow all the curves or bends of the leather or rubber sleeve, while at the same time



tending to support or maintain it in any given position. Larger sizes are reinforced with iron straps or girths spaced from 1½ to 2 feet apart.

As shown in this illustration, galvanized iron or steel flanges are secured to each end of the sleeve by a set of through bolts, the nuts and heads of which bear on rubber or leather washers. The inner sleeve proper, usually of rubber in the latest designs, is carried through and past the flange, where it is flared out into a flange, forming a collar or gasket continuous with the inner hose proper. This makes a water-tight joint with the flanges of the rigid pipe sections and prevents leakage between the gasket and hose proper, as well as the possible lodgment of sand between gasket and flange. Sleeves 20 ins. in diameter will carry 120 lbs. per sq. in. internal pressure. When the leather or rubber lining is worn out a new one can be inserted. This coupling is sold by the New York Flexible Metallic Hose & Tubing Co. of New York city.

LETTERS TO THE EDITOR.

Improvements in Asphalt Paving.

Sirs:—Recent progress in asphalt paving is the topic dealt with in a paper read before the New York Section of the Society of Chemical Industry by Clifford Richardson and published in your issues of June 26 and July 30. Statements coming from the director of a laboratory that has been maintained for nearly twenty years to investigate such subjects at an expense, it is believed, of about $30.000 annually, are bound to be received with attention. The author of the paper describes certain improvements in foundation, binder and surface, which, the readers may logically assume would, if they had been adopted some years ago, result in a more satisfactory pavement than there are now existing. The inference that the adoption of specifications incorporating certain changes that are recommended would necessarily result in a much better grade of pavement than many now laid, does not seem to the writer to be justified. While not denying that pavements laid in accordance with the suggested changes might be better on some streets, the writer is of the opinion that the condition of asphalt pavements complained of in many cities is due to an entirely different cause. In his opinion and in that of many others competent to judge, the fault is due to the commercial conditions existing from about the year 1895 until recently, namely: competion that has forced the price of pavement below cost, due to the entrance into the business of many new people who believed that it was very profitable. Previous to this time, the business had been carried on for the most part on a high plane, so far as workmanship was concerned, making strict inspection on the port of the purchasing municipality unnecessary. Low prices changed all this, and the cities that so readily opened their specifications to admit unrestricted competition of inexperienced contractors handling untried asphalt, were in no position to pay heed to this hitherto needless admonition of the lawyers: "caveat emptor." The purchasers did not look out; the contractors did the best they could for themselves, and in spite of slighted work and scant materials, miles and miles of pavements were laid at less than cost. It is from the consequence of this poor work, rather than the need of improved specifications, from which the public in many places is now suffering. That this is recognized in many quarters is evident from the fact that many city governments are establishing testing stations, planning to do their own work or otherwise arrannging to assume responsibility for the quality of pavements.

To go into the matter in detail, a Portland cement concrete face is recommended in all instances and there certainly is no objection to such a base. However, any immovable base, with a rough surface, answers the purpose equally well. To secure this nothing is more important than rolling, when the subsoil is of such character as to admit of good rolling. Some soils are soft or shifting and cannot be properly rolled. If the subsoil is well rolled it is difficult to see why a natural cement is not just as good as a Portland cement base, and there are miles of good pavements laid on such a base bearing testimony to the fact that it is as good. As to the use of paving stones for a base, that depends somewhat on the paving stones. If the pavement is laid over paving stones that have been in place undisturbed for years, it is doubtful if any defects will develop on account of defective base, if the stones are sufficiently covered with binders. When the stones are all taken and relaid, then the question comes up as to the method of relaying. If the stones were laid on the flat side, as was some times done in New York City, where the specifications did not permit of such work, the results were bad. Where the stones were laid end up, but laid hurriedly and improperly rammed, defects have developed on streets of considerable traffic. Many yards of paving stone have been laid in New York at the rate of 80 or even 100 yards per day to the paver and with only one rammer to two or three pavers. This is not good work. It is an error to attribute the faults of such work to defective specifications as to base.

There are streets in New York now defective where the paving stones, perhaps well enough laid, were insufficiently covered with binders. In the days previous to those of sharp competition, binder was used liberally, if two inches seemed to be needed it was used. Later, when prices were low, a specially screened fine stone was used, so that the binder could be pulled out to the minimum thickness permitted by the specifications and the inspectors. The principal cause of poor pavements laid over stone in New York City is the insufficient thickness of the binders. As to the advantages of a binder in which the voids are filled with sand or stone dust. Probably such a composition is best on streets having car tracks where there is always danger of water working in along the car rails following the binder's course and disintegrating the pavement. A very excellent binder used to be made however by allowing the dust formed in crushing stone to go in with the binder stone. In later days, when economy of first cost had to be put above everything else, the dust was carefully removed from the binder stone in order that a rich looking binder could be made with a smaller per cent of asphalt. The amount of asphalt was often reduced to 50 or 60 pounds to the cubic yard. In order to avoid the dangers of poor binder it is not necessary to specify that the voids of the binder stone shall be filled. Besides there is danger—time alone would tell how great it is—that if the binder is too rich and has an excess of fine material, that the material would push about and cause the pavement to even as readily as it did when an all sand cushion was used between the base and surface.

In the matter of surface mixtures, probably the work of Mr. Richardson's laboratory has done more valuable work than in respect to base and binder. The excellent formula for sand grading announced some years ago was a more definite expression of what was to be desired than had hitherto been made. No doubt it marked a real advance in the business. However it seems, that in some instances it has to be modified, due at times to a certain "balling up" of the mixture. It is not impossible that this balling up may call attention to a matter whose importance is not inferior to the question of regular sand grading. This is a matter more or less known to every practical man, which the writer has been in the habit of defining as the "raking point" of the mixture, having in view in selecting that term the melting point or flowing point of an asphalt cement. For any asphalt mixture made of a given asphalt cement, then there is a temperature at which the mixture should rake out smoothly. For Bermudez asphalt of 65 Don penetration, that temperature should be about 280° F. Assuming then that the mixture should rake freely without balling up at a temperature stated and that the penetration of the cement is as stated, the writer's idea is that any paving mixture composed of such a sand grading as to rake freely at that temperature, and not a lower temperature, is the proper sand grading. Such a sand mixture might, in many instances, compare to a Richardson grading; if it did not, in the writer's opinion, it would be better than a Richardson grading. However, admitting the improvements in surface mixture in recent years, even if commercial reasons have often caused an insufficient percentage of bitumen to be used, it is hard to see why a surface of an inch and a half in thickness should be recommended on any other grounds than those of economy. No doubt with a good two-inch binder, containing a sufficiency of fine material and asphalt, whether voids are filled or not, an inch and a half of surface work should stand very well on almost any street. But an inch and a half asphalt surface will never be as good as a two-inch surface any more than an inch and a half plank is stronger than a two-inch plank.

Reviewing the whole matter then, and bearing in mind as Mr. Richardson says that the American people dearly love something new and experimental, it would seem advisable to look with suspicion on the recent progress in the asphalt paving industry in so far as it may be represented to indicate the desirability of changes in specifications. If changes are to be made, their value should be demonstrated by facts and figures, or at least the nearly unanimous concensus of those whose opinions are valuable.

Yours truly,
F. E. Puffer,
52 North 11th street, Newark, N. J.
July 31, 1907.

Methods and Costs; Some Old, Some New.

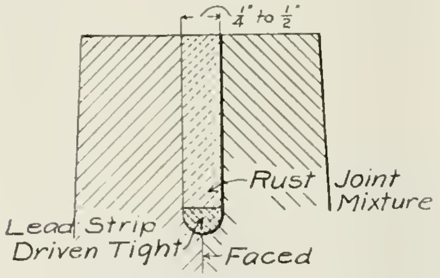
Marking House Lots.—In some cities real estate companies in constructing sidewalks in opening up a new addition stamp the number of the house lot on the surface of the concrete sidewalks. The number is placed at the center line of the lot and is recorded in the books of the company. It will be seen that where the sidewalk is laid in 5-ft. sections it will be an easy matter to determine the boundaries of the lots.

Splicing Piles.—The following method of splicing piles was used by a contractor when single sticks of the right length could not be secured: The bottom pile, 70 ft. long, was driven until the top was within 3 ft. of the water surface. This top was then carefully adzed down to a plane surface and trimmed to a diameter of 10 in. A piece of 10-in. wrought iron pipe 10 in. long was placed on this surface, and the top pile, the point of which had been carefully trimmed to fit on the pipe, was raised in the leads of the pile driver and set on the lower pile. The driving was then continued until the required penetration was reached.

Measuring Flow of Water.—The following is a simple means of ascertaining the approximate number of miner's inches in an open conduit: Select a straight portion of the ditch or flume where the water runs quietly and where no accelerated velocity has been imparted to it. One hundred and ten feet measured along the bank should be called 100 ft. Floats made by weighting empty cartridge shells with shot or small stones and fitting into them cylindrical wooden plugs 4 or 6 ins. long are then placed in the canal as quietly as possible. Note the average time which it takes several of them to traverse the distance, divide the distance in feet by the average time in minutes, and the result will be the velocity in feet per minute; this multiplied by the area in square feet will give the number of cubic feet of water flowing per minute. To get the number of miner's inches, multiply the cubic feet per minute by 2 and divide by 3.

Thawing by Direct Application of Hot Water.—In this column brief mention was made last week of two methods employed in Alaska in thawing out frozen ground in mining operations. Another method is also sometimes used. In this method the thawing is done with hot water by means of a force pump set in the underground workings, which forces hot water through a small nozzle against the bank. At a claim on Gold Run, in the Klondike, where it was desired to extract a 3-ft. pay streak of gravel capped by 27 ft. of barren gravel at a depth of 50 ft. below the surface, a small force pump of the ram pattern, with outside packed valves, was placed in the main runway near the shaft. It drew water from a 6-ft. sump near at hand, to which the workings drained. The pump had 4-in. intake, 3-in. discharge choked to 2½-in., and the water was pumped to the face by means of cotton hose and discharged through a 1-in. brass nozzle at 40 lbs. pressure. Six thousand gallons of water were used over and over, and by discharging the exhaust from the pump into the suction the water was kept at a temperature of 150° F. In a shift of ten hours the pump, using 30 H.P., thawed and broke down ready for the shovelers 175 cu. yds. of gravel.

Caulking Cast Iron Tunnel Lining.—The tubes of cast iron segments with which shield driven tunnels are commonly lined required caulking at all the joints to prevent leakage. The accompanying sketch shows the method of caulking the joints in the cast iron lining of the East River tunnel for the New York Rapid Transit Railway. A strip of lead is first driven tightly into the caulking groove and then the remaining space is filled with a rust joint mixture. A common formula for quick setting rust joint mixture is 1 lb. salammoniac in powder, 2 lbs. flour of sulphur and 80 lbs. iron borings mixed to a paste with water.



Realigning a Brick Stack.—A 250-ft. circular brick stack of 20 ft. interior diameter settled over 1 ft., one side being 6 in. lower than the other, causing the stack to lean toward the westerly side. The stack foundation was of concrete, about 50 ft. square, and rested on clay 16 ft. below the surface. The solid masonry base of the stack rose to a point 10 ft. above the ground, where the brickwork commenced. In order to realign the stack it was decided to spread the foundation on two sides, the greater widening being on the side which had settled most. This was done so that if further slight settlement occurred it would tend to throw the stack back to a vertical position. Extension footings of concrete were accordingly built outside the masonry foundations and bonded to the main structure by cutting slots into the latter, just below the ground level into which the concrete extensions were grouted with steel reinforcement. The slots were 2½ ft. deep by 2½ ft. high and the reinforcement consisted of 12-in. I-beams about 6 ft. long, spaced 16 in. centers. The total area of the new footings was 1,480 sq. ft., of which 970 sq. ft. was on the westerly side, and 510 sq. ft. on the easterly side.

Water Telescope.—A water telescope 12 1-3 ft. long was used as an aid in seeing that the stones were properly placed in some harbor revetment work. The telescope weighed 300 lbs.; this weight being somewhat less than the displacement of the tube allowed it to float about 2 ft. out of the water. Iron rings were afterwards added to adjust the telescope to the proper flotation depth. The telescope was made of four steel plates, two of which were 3-16 in., one ⅛ in. and one 1-16 in. thick. The upper and lower plates were 3 ft. ¾ in. long and the middle plates were 3 ft. 1½ in. long. The tube had a diameter of 12 in. at the object end and a diameter of 4 in. at the eye end. It was fitted with hooks and handles for use in raising and lowering. An iron casing was riveted on the object end of the tube, and projected 4 in. beyond. This casing was provided with planed seats for a plane object glass 13 in. in diameter and ½ in. thick, and for the rubber packing and ring necessary to make watertight joints.

Strong nitric acid is a great aid in cleaning files clogged with tin or lead. For iron filings, use blue vitrol; rinse in water, and dip in nitric. For copper or brass, use ntiric several times; for zinc, dilute sulphuric acid. After any of these treatments, rinse the files in water, brush vigorously, and dry in sawdust, or by burning alcohol on the file.

Engineers' Pocketbook of Reinforced Concrete.*

By E. Lee Heidenreich, C. E., E. M.

(Continued from Engineering-Contracting, Aug. 7, 1907.)

Inasmuch as an abutment is a retaining wall with a surcharge, we will consider the two classes of construction under one head. The author is under obligations to Prof Milo S. Ketchum, of the University of Colorado for much of the following, which by permission has been compiled from "The Design of Walls, Bins and Grain Elevators."

In calculating the thrust on a retaining wall, great care must be used in selecting the proper value for the angle of repose and the conditions of surcharge, as the value of the thrust increases very rapidly as the angle of repose decreases and as the angle of surcharge increases.

The filling back of the wall should be deposited and tamped in approximately horizontal layers or in layers sloping back from the wall, and a layer of sand, gravel or other porous material should be deposited between the fill and the wall to drain the fill downwards.

To insure drainage of the filling, drains should be provided back of the footing, and weep-holes located in the body of the wall at close intervals. The filling in front of the wall should also be carefully drained.

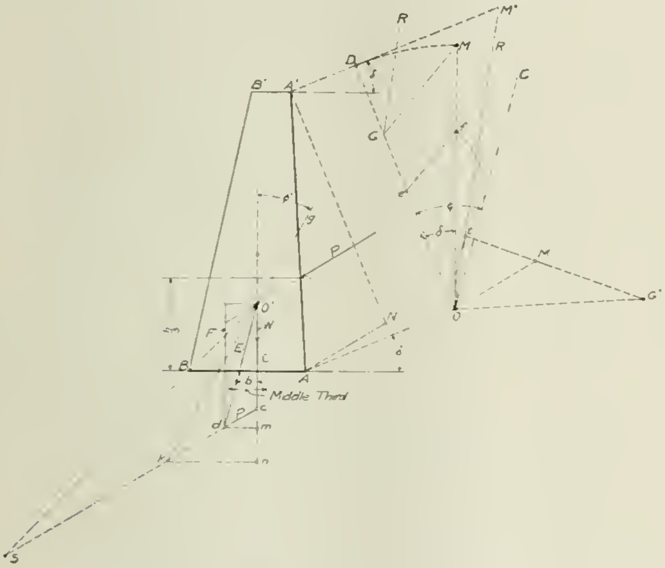


Fig. 1. Diagram of Forces for Masonry Retaining Wall.

In order to prevent the heaving of the foundation by frost, it is usual to provide from 2½ to 5 ft. of filling in front of the wall. While in solid masonry walls it is necessary to locate expansion joints at intervals of from 30 to 50 ft., to prevent cracks, such joints are frequently omitted in retaining walls of reinforced concrete, and reinforcement is placed in the direction of the length of the wall for such purpose.

Mr. A. L. Johnson gives the following formula for the amount of reinforcement required to prevent temperature cracks:†

$$\text{Area of steel} = \frac{\text{tensile strength of concrete}}{\text{elastic limit of steel}} \times \text{area of concrete.}$$

For mild steel the elastic limit is 33,000 lbs. per sq. inch, the tensile strength of concrete is about 200 lbs. per sq. inch, and the area of steel is $\frac{1}{165}$ of the area of the wall. For high steel of an elastic limit of 55,000 lbs. per sq. in., we find the area of steel required to prevent temperature cracks equal to

Mr. W. W. Colpitts recommends 0.6 sq. in. of steel per

$\frac{1}{275}$ of the area of the wall.

sq. ft. of concrete* which is $\frac{1}{240}$ the area of the wall.

The author recommends a wire fabric of high carbon steel with the carrying rods running horizontally and located not more than 2 ins. from the face of the wall

The design of retaining walls will be illustrated by showing the calcuation of a masonry retaining wall by means of

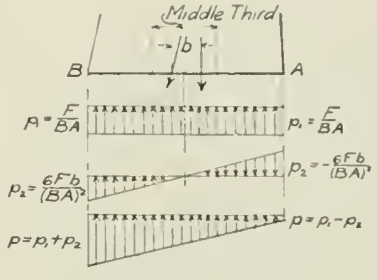


Fig. 2. Diagram of Moments for Masonry Retaining Wall.

the ellipse of stress, and two examples of reinforced concrete retaining walls:

Masonry Retaining Wall.—Design a retaining wall height = h, angle of surcharge = 22°30′, and the angle of repose, 37°30′. See Fig. 1.

To calculate the resultant pressure, P, proceed as follows: Draw AO parallel to the surcharge A′M″ and at any convenient point O in AO draw OD at right angles to AO. Draw OM vertical and locate M by striking the arc DM with O as a center, and OD as a radius. Draw OC making the angle Φ with OD. At any point e in OD describe an arc tangent to OC and cutting OM at f. Through M draw MG parallel to ef. Bisect the angle DGM and through O draw OR parallel to GR′. Then OR is the principal axis of the ellipse of stress and OM″ the maximum stress that can occur in the filling. To calculate the maximum stress at A, draw OG′ at right angles to the back of the wall AA′, and make OG′ = OG. With G′ as center and OG′ as radius, describe an arc cutting the principal axis OR at t. Draw G′t, and with G′ as a center and GM as a radius locate M′. Then

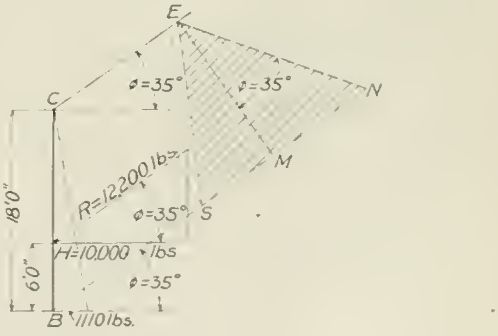


Fig. 3. Diagram of Forces for Reinforced Concrete Wall.

M′O acting as shown is the intensity of the stress at A. The resultant pressure P is equal to the area of the stress triangle AA′N × w, where w is the weight per cubic ft. of the fill. P. acts on AA′ at 1-3 the height of the wall.

The weight of the masonry, W, combined with P gives the resultant E, which must cut the foundation within the middle third. The vertical component of E is F.

1.—Stability Against Overturning.—Through B draw O′S and produce cd to S. Then the factor of safety against overturning is $\frac{Sc}{dc}$. If E passes through B, the wall would be on the point of overturning and $\frac{Sc}{dc}$ would be equal to 1.

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†Railroad Gazette, March 13, 1903.

*Railway Age, January, 1904.

2.—Stability Against Sliding.—The angle of friction of the masonry against the footing we will take as

$$\Phi' = 30°.$$

Through O′ draw gk cutting the base of the wall at i at 30° to the vertical. Then the factor of safety against sliding will be

$$\frac{kn}{dm}$$

3.—Stability Against Crushing.—The direct pressure per sq. ft. will be

$$p_1 = \frac{F}{BA},$$

where BA is the width of base.

The pressure due to the bending moment will be (See Fig. 2)

$$p_2 = \pm \frac{6Fb}{(BA)^2}.$$

The maximum pressure will be

$$p = p_1 + p_2,$$

and the minimum

$$p = p_1 - p_2.$$

If, in addition to the foregoing assumptions, we assume the wall to be 18 ft. high,

A′B′ = 2 ft. 6 ins.,

AB = 7 ft. 6 ins.,

the batter of the back wall AA′ ¾ ins. per ft., the masonry to weigh 150 lbs. per cu. ft., and the fill, w, 100 lbs. per cu. ft., we find the following result:

$$P = \frac{16 \times 6.1}{2} \times 100 = 4880.$$

$$W = \frac{2.5 + 7.5}{2} \times 18 \times 150 = 13500 \text{ lbs. per lin. ft. of wall.}$$

$$E = 16500.$$

$$b = 1.1 \text{ ft.}$$

$$F = 16000$$

$$p_1 = \frac{16000}{7.5} = 2133$$

$$p_2 = \frac{6Fb}{d^2} = \frac{6 \times 16000 \times 1.1}{7.5 \times 7.5} = \pm 1877.$$

$$p = 4010 \text{ or } 256.$$

Reinforced Concrete Retaining Wall, Ex. 1.—The design of a reinforced concrete retaining wall of the beam type, to carry a sand filling 16 ft. high, weighing 100 lbs. per cu. ft., and having an angle of repose of 35°, and sloping back at that angle.

The Vertical Beam.—The bottom of the foundation will need to be about 4 ft. deep and we will assume the stem of the wall to be 18 ft. high. In Fig. 3 the pressure is

$$P = \triangle \text{ SEN} \times w = 12{,}200 \text{ lbs.}$$

and is parallel to the top surface. The horizontal component of P is

$$H = 10{,}000 \text{ lbs.}$$

The bending moment about B is

$M^1 = 10{,}000 \times 6 = 60{,}000$ ft. lbs., for 1 ft. wide, or inch lbs. for 1 in. wide.

Instead of using table page 79 we will make n = 12, p = 0.006 and f = 16,000. According to page 68* we have

$$\left(1 - \frac{k}{3}\right) = 0.896 \text{ and}$$

$$M_s = pf\left(1 - \frac{k}{3}\right)bd^2$$

$$d = \sqrt{\frac{60{,}000}{0.006 \times 16{,}000 \times 0.896}} = 26.6 \text{ ins.}$$

and h = 30 ins. The top is 12 ins. thick.

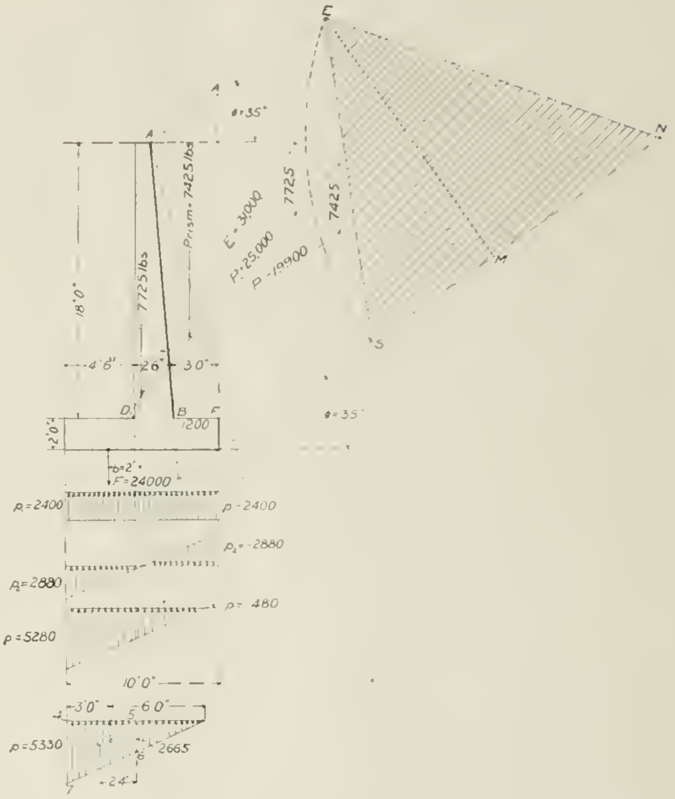

Fig. 4. Diagram of Forces for Reinforced Concrete Wall.

The steel reinforcement required per in. is 0.199 sq. ins. For 4 ins., 4 × 0.199 = 0.796 sq. ins. This would be equivalent to fabric of 1 in. rods, 4 ins. on centers.

Foundations.—We will assume that the footing is 2 ft. thick and 10 ft. long as shown in Fig. 4. Then the pressure on the plane A′F is

$$P' = 19{,}900 \text{ lbs.}$$

The weight of the earth prism AA′ BF is 7,425 lbs and

$$P = 25{,}000 \text{ lbs.}$$

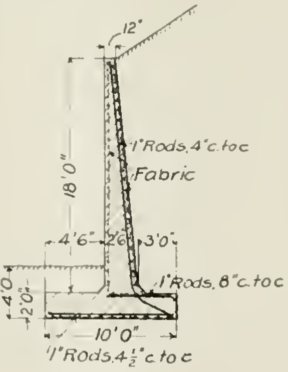

Fig. 5. Section of Reinforced Concrete Retaining Wall.

Combining P and the weight of the wall, which including reinforcement, we will call 7,725 lbs., we have

$$E = 31{,}000 \text{ lbs.,}$$

which cuts the base 2 ft. to the left of the center, outside the middle third.

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*Tables referred to were reprinted in Engineering-Contracting in issue of July 31, 1907.

Now

$F = 24{,}000$ lbs., and

$p_1 = 2{,}400$ lbs., per sq. ft.,

$$p^2 = \frac{6Fb}{d^2} = \pm 2{,}880 \text{ lbs., hence}$$

$p = 5{,}280$ or -480 lbs. per sq. ft.

Since the foundation cannot take tension we will have to let all the load be taken by compression as follows:

$$p_1 = \frac{2F}{3a} = \frac{2 \times 24000}{3 \times 3} = 5{,}333 \text{ lbs. per sq. ft.}$$

This pressure is safe for good gravel or clay. While the resultant cuts outside the middle third the base is sufficiently long for the conditions named.

To calculate the bending moment to the left of D, take the lower stress diagram 4-5-6-7, Fig. 4, and multiply it by the distance of its center of gravity to the left of D.

$$\text{Then } M^1 = \left(\frac{5{,}333 + 2{,}665}{2}\right) 4\tfrac{1}{2} \times 2.4 = 43{,}200 \text{ ft. lbs.}$$

The table, page 79,* gives for a moment of 50,340, $h = 24$, and for 41,600, $h = 22$.

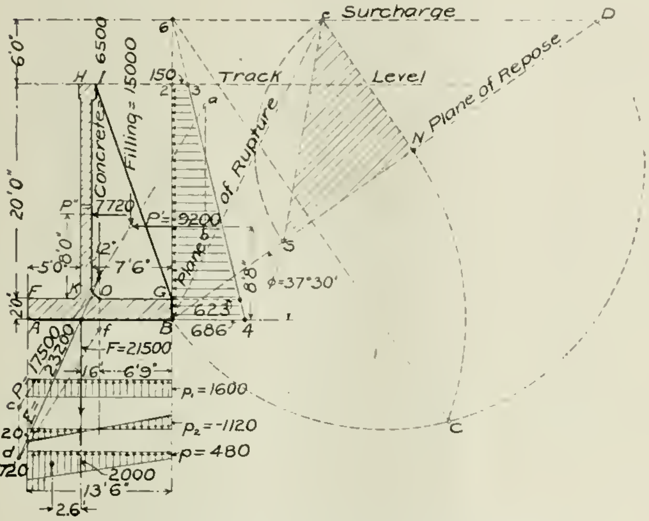

Fig. 6. Moment and Stress Diagram for Reinforced Concrete Retaining Wall.

We will let our selection of 24 ins. stand, and put in $0.17 \times 4\tfrac{1}{2} = 0.765$ sq. ins., or 1-inch rods 4½ ins. on centers, the full length of the foundation. Rods will be placed 2 ins. from top of the inner surface as shown, and these rods we will make 1 in. in diameter, and 8 ins. on center. See Fig. 5.

Example 2.—Design a reinforced concrete retaining wall with counterforts to carry a sand filling 17½ ft. above ground, which weighs 100 lbs. per cu. ft., has an angle of repose of 37°30', and carries a railroad track which is equivalent to a surcharge of 6 ft. Counterforts to be spaced 10 ft. on centers as shown in Fig. 7.

The pressure P' on the vertical plane 2—B is calculated graphically as shown in Fig. 6.

Δ SeN × w = pressure on the vertical plane B-6, and the pressure triangle is B-6-4. Resultant pressure P' acts through the center of gravity and is equal to the area B-2-3-4, equals 9,200 lbs. Resultant pressure P" acting on plane G-2 is found to be 7,700 lbs.

The weight of the prism of filling O-I-2-G is 15,000 lbs., and combining this weight with P', we have

$P = 17{,}500$ lbs.,

acting as shown. The weight of the concrete wall per lineal foot is approximately 6,500 lbs., which when combined with P gives

$E = 23{,}200$ lbs.

Resultant E cuts the base at a distance 1.6 ft. from the center, and the vertical component of E is

$F = 21{,}500$ lbs.

Vertical Wall.—In designing the center slab the span will be taken as 10 ft. (Where the wall has no cracks the actual span is less than the clear span of 8 ft. 6 ins.) Taking the bottom strip, 1 ft. wide, and 10 ft. long, we design a simple beam that will carry a load of 623 lbs. per linear ft.

$$M = \frac{623 \times 10^2}{8} = 7{,}788 \text{ ft. lbs. (or inch lbs. per inch).}$$

$$M_s = pf\left(1 - \frac{k}{3}\right) bd^2$$

Again making $n = 12$, $p = 0.006$, and $f = 16{,}000$, we get

$$d = \sqrt{\frac{7{,}788}{0.006 \times 16{,}000 \times 0.896}} = 9.5 \text{ ins. and } h = 12 \text{ ins.}$$

The steel area per foot is:

$0.006 \times 9.5 \times 12 = 0.684$ sq. ins., or ¾ in. rods, 8 ins. on centers, grading the distance between rods according to the decreasing pressure toward the top. See Fig. 7. The temperature stresses will be taken care of by means of 4 × 6 in. No. 7 and No. 9 fabric, to which the rods are fastened by wire—usually doubled No. 18 annealed wire.

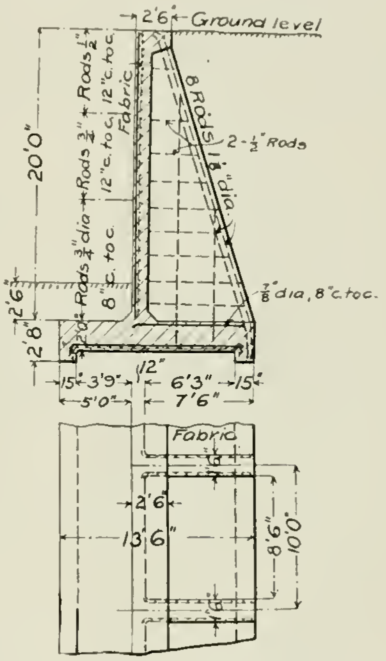

Fig. 7. Plan and Section of Wall, Showing Reinforcement.

Counterforts.—The bending moment on a counterfort at OG in Fig. 6 will be

$M' = 7{,}720 \times 8 \times 10 = 617{,}600$ ft. lbs., or 7,411,200 in. lbs.

If the counterfort is 18 ins. wide we have—

$$M = \frac{7{,}411{,}200}{18} = 411{,}733 \text{ in. lbs., for 1 in. width}$$

Table, page 68,

$$m_s = pf\left(1 - \frac{k}{3}\right) bd^2$$

and for $f = 16{,}000$, $p = 0.006$, and $n = 15$, we find

$$\left(1 - \frac{k}{3}\right) = 0.885.$$

$$\text{Hence } d = \sqrt{\frac{411{,}733}{0.006 \times 16{,}000 \times 0.885}} = 70 \text{ ins.} = 6 \text{ ft. } 8 \text{ ins.}$$

Steel area for 18 ins. width is

$0.006 \times 70 \times 18 = 7.56$ sq. ins.,

or 8 rods, 1⅛ ins. diameter. Rods ½ in. in diameter will be placed as shown in addition to fabric to take vertical and horizontal shear.

Foundations. In Fig. 6 the direct pressure p_1 is 1,600 lbs per sq. ft., while the pressure due to the moment is

$$p_2 = \frac{6Fb}{d^2} = \pm 1{,}120 \text{ lbs. per sq. ft.}$$

Then

$$p = 2{,}720 \text{ or } 480 \text{ lbs. per sq. ft.}$$

which is entirely safe for ordinary conditions. The maximum moment at K in the outer toe is found in Fig. 6 by taking the moment area to the left of K, and is

$$M^1 = \left(\frac{2{,}720 + 2{,}000}{2}\right) 5 \times 2.6 = 30{,}680 \text{ ft. lbs.}$$

By table page 79 this corresponds to a slab between 19 and 20 ins. However, we have assumed 24 ins. We will use steel area of 0.15 sq. in. per inch, or ⅞-in. rods 4 ins. on centers and place ⅞-in. rods 8 ins. on centers at top of slab as shown. At the bottom we will, in addition to 4 × 6-in. fabric of Nos. 7 and 9 gauge, place ⅝-in. distributing rods longitudinally 8 ins. on centers.

It will be noticed that in the foregoing example a rib is placed longitudinally underneath the heel and the toe of the base; this is largely for the purpose of confining the soil between the two ribs and to aid in preventing sliding.

Personals.

Mr. Walter M. Smith, Sr., has resigned his position as Division Engineer, Board of Water Supply of New York City.

Mr. James Kearney has resigned his position as Assistant Engineer, Bureau of Highways, Borough of the Bronx, New York City.

Mr. E. L. Trowbridge has been appointed Assistant to the Engineer of Construction of the Louisville & Nashville R. R., at Louisville, Ky., succeeding Mr. H. W. Oliver, who has resigned.

Mr. Samuel H. Lea, in addition to his duties as State Engineer of South Dakota, has been appointed Superintending Engineer of the South Dakota capitol building now in course of erection at Pierre.

Mr. E. Clark Cowden has resigned his position in the Pennsylvania State Highway Department and has opened offices in the Commonwealth Trust Bldg., Harrisburg, Pa., where he will engage in a general surveying business.

Mr. A. C. Brower has been appointed Division Engineer of the Missouri Pacific Ry., with headquarters at Wichita, Kan. He succeeds Mr. E. C. Welch, who has been transferred to the St. Louis, Iron Mountain & Southern Ry.

Mr. W. B. Causey, heretofore Engineer of Maintenance of Way of the Chicago & Alton R. R. at Bloomington, Ill., has been appointed Superintendent with headquarters at that place. He succeeds Mr. W. L. Derr, who has resigned to go with another company.

Mr. C. R. Fredericks has been appointed Superintendent of Construction of the Federal Construction Co., of New York. The company has the general contract for building Mississippi Valley Electric Rialway and water works at Nauvoo, Ill. Mr. Fredericks will make his headquarters at Nauvoo.

Mr. William H. Butler, Consulting Engineer, St. Louis, Mo., has been selected to make a detailed inspection of the plant of the Washington Water & Light Co., of Washington, Mo. He will report upon its physical condition and appraise its present cash value, the city having given notice of its desire to purchase the water system at the expiration of the present franchise.

Messrs. A. P. Dow and F. P. Smith have entered upon a partnership under the firm name of Dow & Smith, and have opened offices at 120 E. 23rd St., New York City. They will specialize in asphalt paving for cities and will act as consulting engineers on road surfaces of all kinds. Mr. Dow was formerly Inspector of Asphalts and Cement for the city of Washington, D. C., and Mr. Smith has been chemist and asphalt expert for the Alcatraz Co., the Union Oil Co., of California, the British Paving Co., Ltd., and the A. L. Barber Asphalt Co., as well as Chemist to the U. S. Navy Department.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0305. **Pneumatic Tools.**—Ingersoll-Rand Company, New York, N. Y.

In this pamphlet the company named above gives an excellent description in detail of its "Crown" Chipping and Riveting Hammers. These hammers are described fully, each part being taken up separately and explained by means of suitable text and drawings. Tables are also given of dimensions, capacity, etc. There is a section on the care of pneumatic hammers and also a section describing the company's Air Meter for measuring the air consumption of pneumatic tools. The pamphlet is well written and illustrated and should be useful to anyone desiring a description of this type of hammer.

No. 0306. **Electric Drills.**—Box Electric Drill Company, New York, N. Y.

This pamphlet illustrates by means of line drawings and half-tones the construction of the Electric Drill manufactured by the company named. Special claim is made for the compact and rugged construction of this drill, making it as sturdy as the ordinary compressed air drill for heavy work.

No. 0307. **Locomotive Cranes.**—The McMyler Manufacturing Company, Cleveland, O.

The company issuing this pamphlet, as most of our readers know, has made a specialty of designing and building heavy hoisting and conveying machines. This particular pamphlet is devoted to a description and illustration of the several types of Locomotive Cranes manufactured by the company. Each type of crane is briefly described and is illustrated in sufficient detail to give a clear understanding of its characteristic features.

No. 0308. **Pressed Steel Plank Holders.**—J. H. Sullivan, Grand Rapids, Mich.

The device described in this pamphlet is designed to do away with the use of nails or bolts in assembling the forms for reinforced concrete work. It consists of a pressed steel clamp or holder by which the planks forming the molds are kept in true line and position without the use of any of the ordinary fastenings. The pamphlet describes the construction of the holder and shows its application in constructing the forms for buildings and retaining walls and a great variety of other concrete structures.

No. 0309. **Electric Hoists.**—General Electric Company, Schenectady, N. Y.

This is Bulletin No. 4518, issued by the above company. It describes the numerous applications of electric hoisting machinery and gives an outline of the work which the General Electric Company is doing in that field. The hoists are illustrated and described in detail and tables of capacities, dimensions, prices, etc., are given.

CONTRACT NEWS

We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Bids Open.		See Issue.
Aug. 15.	Logan, O	Aug. 14
Aug. 15.	Tanawanda, Pa	Aug. 14
Aug. 15.	Mount Gilead, O	July 24
Aug. 15.	Jackson, O	July 24
Aug. 16.	Cincinnati, O	July 24
Aug. 16.	Denver, Colo.	Aug. 7
Aug. 16.	Spokane, Wash	July 31
Aug. 16.	Pateros, Wash	Aug. 14
Aug. 16.	Cincinnati, O	Aug. 14
Aug. 16.	Fond du Lac, Wis	Aug. 14
Aug. 17.	Port Clinton, O	Aug. 14
Aug. 19.	Jefferson, O	July 31
Aug. 19.	Council Bluffs, Ia	Aug. 7
Aug. 19.	Columbus, O	Aug. 14
Aug. 19.	Youngstown, O	Aug. 14
Aug. 19.	Urbana, O	Aug. 14
Aug. 19.	Andover, O.	Aug. 14
Aug. 19.	Los Angeles, Cal	Aug. 14
Aug. 19.	Redwood City, Cal	Aug. 14
Aug. 20.	San Juan, P. R	July 24
Aug. 20.	Des Moines, Ia	Aug. 7
Aug. 20.	Ft. Myer, Va	Aug. 14
Aug. 21.	Cleveland, O	Aug. 14
Aug. 22.	Chambersburg, Pa	Aug. 14
Aug. 22.	Bloomsburg, Pa	Aug. 14
Aug. 23.	Sandusky, O.	Aug. 7
Aug. 23.	Pittsburg, Pa.	Aug. 7
Aug. 24.	Lebanon, O.	Aug. 7
Aug. 28.	Washington, D. C	Aug. 14
Aug. 31.	Lima, O	Aug. 14
Sept. 2.	Tarboro, N. C	July 31
Sept. 4.	Glasgow, Mont	July 31
Sept. 9.	Paquemine, La	Aug. 14
Sept. 16.	Madera, Cal	Aug. 14
Sept. 30.	Santiago, Chile	July 17

Buildings.

Aug. 14.	New York, N. Y	Aug. 7
Aug. 14.	Springfield Township, O.	July 24
Aug. 14.	Washington, D. C	July 31
Aug. 14.	Ionia, Mich	July 31
Aug. 15.	Boston, Mass.	Aug. 7
Aug. 15.	Thompson, Ia.	Aug. 7
Aug. 15.	Fort Myer, Va	Aug. 7
Aug. 15.	Walter, Okla.	Aug. 7
Aug. 15.	Fort Leavenworth, Kan.	Aug. 7
Aug. 15.	Humboldt, Ia.	Aug. 7
Aug. 15.	New York, N. Y	July 31
Aug. 15.	Philadelphia, Pa	July 31
Aug. 15.	Stonington, Conn	July 31
Aug. 15.	Albany, N. Y	July 24
Aug. 15.	North Chicago, Ill	July 24
Aug. 15.	Bakersville, N. C	July 17
Aug. 15.	Terre Haute, Ind	July 24
Aug. 15.	Springfield, Mass	Aug. 14
Aug. 15.	Wilkinsburg, Pa	Aug. 14
Aug. 15.	Kalkaska, Mich	Aug. 14
Aug. 15.	Boston, Mass	Aug. 14
Aug. 15.	Maynooth, Ont	Aug. 14
Aug. 15.	Howell, Mich	Aug. 14
Aug. 17.	Columbus, Grove., O	Aug. 14
Aug. 17.	Huntsville, Ala	Aug. 14
Aug. 17.	Lafayette, Ind.	Aug. 7
Aug. 17.	Peru, Ind	July 24
Aug. 18.	Decatur, Ill	Aug. 14
Aug. 19.	Newark, O	Aug. 14
Aug. 19.	Alexandria, Minn	July 17
Aug. 20.	Decatur, Ill	July 17
Aug. 20.	Spearfish, S. Dak	July 24
Aug. 20.	Montevallo, Ala	July 24
Aug. 20.	Athens, O	July 31
Aug. 20.	Lumberton, N. C	July 31
Aug. 20.	Ellendale, N. D	Aug. 14
Aug. 20.	Vermilion, S. D	Aug. 14
Aug. 20.	Newberry, Mich	Aug. 14
Aug. 20.	Hackensack, N. J	Aug. 14
Aug. 21.	Ames, Ia	Aug. 14
Aug. 21.	Fort Dodge, Ia	July 31
Aug. 22.	Jackson, Miss	July 24
Aug. 22.	Jackson, Mich	July 17
Aug. 22.	Orient, O.	Aug. 7
Aug. 22.	Negaunee, Mich	Aug. 14
Aug. 23.	Portland, Me	Aug. 14
Aug. 23.	Washington, D. C	Aug. 7
Aug. 23.	Delaware, O	July 31
Aug. 24.	Geneva, Ill	July 17
Aug. 26.	Toledo, O	Aug. 14
Aug. 26.	Republic, Mich	Aug. 14
Aug. 26.	Milwaukee, Wis.	Aug. 7
Aug. 27.	Springfield Township, O.	Aug. 7
Aug. 27.	Trenton, N. J	July 31
Aug. 28.	Portland, Ore	Aug. 14
Aug. 28.	Anthony, Kan	Aug. 14
Aug. 28.	Cleveland, O	Aug. 14
Aug. 28.	Fort Smith, Ark	Aug. 14
Aug. 29.	Peru, Ind	Aug. 14
Aug. 29.	Wahpeton, N. Dak	Aug. 7
Aug. 29.	Iowa City, Ia	Aug. 7
Aug. 30.	Moscow, Idaho	Aug. 14
Sept. 3.	Cleveland, O	Aug. 14
Sept. 3.	Watertown, N. Y	July 31
Sept. 3.	Bloomfield, Ind	July 31
Sept. 3.	Washington, D. C	Aug. 7
Sept. 3.	Bloomfield, Ind.	Aug. 7
Sept. 4.	Quincy, Mass	July 31
Sept. 5.	Evansville, Ind.	Aug. 7
Sept. 11.	Eureka, Cal	Aug. 14
Sept. 16.	Pittsburg, Pa.	Aug. 7
Sept. 16.	Buffalo, N. Y	Aug. 7
Sept. 17.	San Francisco, Cal	Aug. 14
Sept. 19.	Muscatine, Ia	Aug. 14
Sept. 23.	Cedar Rapids, Ia	Aug. 14

Roads and Streets.

Aug. 14.	Brooklyn, N. Y	Aug. 7
Aug. 14.	New York, N. Y	Aug. 7
Aug. 14.	New York, N. Y	Aug. 7
Aug. 14.	Baltimore, Md.	Aug. 7
Aug. 14.	Marshall, Tex.	Aug. 7
Aug. 14.	Toledo, O.	Aug. 7
Aug. 14.	Fort Riley, Kan	Aug. 7
Aug. 15.	Kansas City, Mo	Aug. 7
Aug. 15.	Saginaw, Mich.	Aug. 7
Aug. 15.	Elizabeth, N. J	July 31
Aug. 15.	Long Island City, L. I., N. Y.	Aug. 14
Aug. 15.	Bloomington, Ill	Aug. 14
Aug. 15.	Cairo, Ill	Aug. 14
Aug. 15.	Geneva, N. Y	Aug. 14
Aug. 16.	Milwaukee, Wis	Aug. 14
Aug. 16.	Olympia, Wash	Aug. 14
Aug. 16.	Covington, Ind	Aug. 14
Aug. 16.	Olympia, Wash	Aug. 7
Aug. 16.	Cincinnati, O.	Aug. 7
Aug. 17.	Ottawa, O.	Aug. 7
Aug. 17.	Huntsville, Ala	July 31
Aug. 17.	Cleveland, O	July 24
Aug. 17.	Oshkosh, Wis	Aug. 14
Aug. 17.	Bedford, Ind	Aug. 14
Aug. 17.	Terre Haute, Ind	Aug. 14
Aug. 19.	New Haven, Conn	Aug. 14
Aug. 19.	Syracuse, N. Y	Aug. 14
Aug. 19.	Tipton, Ind	Aug. 14
Aug. 19.	Toledo, O	Aug. 14
Aug. 19.	Pembroke, N. H	Aug. 14
Aug. 19.	New York, N. Y	Aug. 14
Aug. 19.	Tipton, Ind.	Aug. 7
Aug. 19.	Steubenville, O.	Aug. 7
Aug. 19.	Westfield, N. J	Aug. 7
Aug. 20.	Cleveland Heights, O	July 24
Aug. 20.	Cleveland Heights, O	July 24
Aug. 20.	Sandusky, O	Aug. 14
Aug. 20.	Dundee, Mich	Aug. 14
Aug. 20.	Elizabeth, N. J	Aug. 14
Aug. 20.	Wildwood, N. J.	Aug. 14
Aug. 20.	Woodcliff, N. J	Aug. 14
Aug. 21.	Brooklyn, N. Y	Aug. 14
Aug. 21.	Winchester, Ind	Aug. 14
Aug. 21.	Aberdeen, Wash	Aug. 14
Aug. 21.	Aberdeen, Wash.	Aug. 7
Aug. 21.	Fort St. Philip, La	Aug. 7
Aug. 21.	New York, N. Y	Aug. 14
Aug. 22.	Kansas City, Mo	Aug. 14
Aug. 22.	Kansas City, Mo	Aug. 14
Aug. 23.	Janesville, Wis	Aug. 14
Aug. 23.	Mt. Gilead, O	Aug. 14
Aug. 23.	Valparaiso, Ind	Aug. 14
Aug. 23.	Sullivan, Ind.	Aug. 14
Aug. 23.	Etna, N. J	Aug. 14
Aug. 24.	Watertown, Wis	Aug. 14
Aug. 24.	Prescott, Ariz	July 31
Aug. 26.	Pittsburg, Pa.	Aug. 7
Aug. 26.	Jacksonville, Fla	Aug. 14
Aug. 27.	Frankfort, Ind	Aug. 14
Aug. 27.	Pensacola, Fla	July 31
Aug. 28.	Hoboken, N. J	Aug. 14
Aug. 28.	Hoboken, N. J	Aug. 7
Aug. 28.	Hoboken, N. J	July 31
Aug. 28.	Fort Lee, N. J	Aug. 7
Aug. 29.	Smethport, Pa	Aug. 14
Aug. 30.	Tipton, Ind	Aug. 14
Aug. 30.	Marshfield, Mo	Aug. 14
Aug. 30.	Cincinnati, O.	Aug. 7
Aug. 30.	Marshfield, Mo	July 31
Sept. 3.	Beardstown, Ill	Aug. 14
Sept. 3-4-5.	Albany, N. Y	Aug. 14
Sept. 3.	New Philadelphia, O	Aug. 7
Sept. 3.	Yorktown, Va.	Aug. 7

Sewers.

Aug. 14.	Brooklyn, N. Y	Aug. 7
Aug. 14.	Oakland, Cal	July 31
Aug. 14.	Boise, Idaho	July 31
Aug. 15.	Winnebago, Minn	Aug. 14
Aug. 15.	Elizabeth, N. J	Aug. 14
Aug. 15.	Newark, N. J	Aug. 14
Aug. 15.	Long Island City, L. I., N. Y.	Aug. 14
Aug. 15.	Baraboo, Wis	Aug. 14
Aug. 15.	St. Paul, Minn	Aug. 7
Aug. 15.	Cleveland, O.	Aug. 7
Aug. 15.	Staples, Minn.	Aug. 7
Aug. 15.	Arkadelphia, Ark	July 31
Aug. 15.	Elizabeth, N. J	July 31
Aug. 15.	Camden, Ark	July 24
Aug. 16.	Milwaukee, Wis	Aug. 14
Aug. 17.	Evansville, Ind	Aug. 14
Aug. 17.	Asbury Park, N. J	Aug. 7
Aug. 19.	Webster Groves, Mo	Aug. 7
Aug. 19.	Riverside, N. J	Aug. 7
Aug. 19.	Port Clinton, O	July 24
Aug. 19.	Cape Girardeau, Mo	July 31
Aug. 19.	West Lafayette, Ind	Aug 14
Aug. 19.	St. Paul, Minn	Aug. 14
Aug. 19.	Pembroke, N. H	Aug. 14
Aug. 19.	Whitesboro, N. Y	Aug. 14
Aug. 20.	Athol, Mass	Aug. 14
Aug. 20.	Nevada, Mo	Aug. 14
Aug. 20.	West New York, N. J	Aug. 14
Aug. 20.	Wildwood, N. J	Aug. 14
Aug. 20.	Cleveland, O	Aug. 14
Aug. 20.	Collinsville, Ill	July 31
Aug. 20.	Cleveland Heights, O	July 24
Aug. 21.	North Chicago, Ill	July 31
Aug. 21.	Aberdeen, Wash	Aug. 14
Aug. 22.	Kansas City, Mo	Aug. 14
Aug. 22.	Fayetteville, Ark	July 24
Aug. 23.	Delaware, O	July 31
Aug. 26.	Baden, Pa	Aug. 14
Aug. 28.	Louisville, Ky	Aug. 14
Aug. 30.	Fort Dade, Fla	Aug. 14
Aug. 30.	Evansville, Ind	July 24
Aug. 31.	Canal Dover, O	Aug. 14
Aug. 31.	Elroy, Wis	Aug. 14
Sept. 6.	Iowa City, Ia	Aug. 7
Sept. 11.	New Orleans, La	July 10

Water Supply.

Aug. 16.	Homestead, Pa	Aug. 14
Aug. 19.	Geneseo, Ill	Aug. 14
Aug. 19.	Sacramento, Cal.	June 5
Aug. 19.	Lombard, Ill	July 31
Aug. 20.	Dawson, Minn	Aug. 7
Aug. 20.	Russellville, Ark	July 24
Aug. 20.	Philadelphia, Pa	Aug. 14
Aug. 20.	Louisville, Ky	Aug. 14
Aug. 20.	Lewisburg, Tenn	Aug. 14
Aug. 21.	Springfield, Mass	July 31
Aug. 21.	Fort Hancock, N. J	July 31
Aug. 22.	Philadelphia, Pa	July 31
Aug. 23.	Westboro, Mass	Aug. 14
Aug. 26.	Cumberland, Md	Aug. 14
Aug. 26.	Ashland, O.	Aug. 27
Aug. 27.	Cincinnati, O	July 31
Aug. 29.	Philadelphia, Pa	Aug. 14
Aug. 30.	Fort Dade, Fla	Aug. 14
Aug. 31.	Chicago, Ill	Aug. 14

Aug. 31. Chicago, Ill.....................Aug. 14
Aug. 31. Chicago, Ill.....................Aug. 14
Sept. 2. Carrington, N. Dak.......Aug. 7
Sept. 3. Kansas City, Mo.........Aug. 14
Sept. 3. Victoria, B. C..............Aug. 14
Sept. 4. New Orleans, La. ....July 3
Sept. 6. Montreal, Que..............Aug. 14

Miscellaneous.

Aug. 14. Oakland, Cal., Street Sweeping, July 31
Aug. 14. Key West, Fla., Breakwater, July 31
Aug. 14. Baltimore, Md., Pier Work, Aug. 7
Aug. 15. New York, N. Y., Fire Stations, Aug. 14
Aug. 15. Campbellford, Ont., Power Development, Aug. 14
Aug. 15. Ft. Leavenworth, Kans., Electric Wiring, Aug. 14
Aug. 15. New York, N. Y., Pier Work, Aug. 7
Aug. 15. Boston, Mass., Subway Entrance, July 31
Aug. 16. Boston, Mass. Harbor Work, Aug. 14
Aug. 16. Galveston, Tex., Jetty Work, July 24
Aug. 16. Brooklyn, N. Y., Pier Work, Aug. 14
Aug. 16. Stapleton, S. I., N. Y., Pier Work, Aug. 14
Aug. 16. Henry, Ill., Steam Heating Plant, Aug. 14
Aug. 19. New York, N. Y., Dock Work, Aug. 14
Aug. 19. Washington, D. C., Steam Vessel, July 24
Aug. 20. San Diego, Cal., Wharf and Trestle, June 26
Aug. 20. Fort Ontario, N. Y., Fence, Aug. 7
Aug. 20. Dawson, Minn., Electric Light Plant, Aug. 14
Aug. 21. New York, N. Y. Dock Work, Aug. 14
Aug. 22. Shawneetown, Ill., Levee Work, Aug. 14
Aug. 22. Blackwell's Island, N. Y., Electric Light Plant, Aug. 14
Aug. 22. New York, N. Y., Electric System, Aug. 7
Aug. 23. Newark, N. J., Electric Light Plant, Aug. 14
Aug. 24. Fort Greble, R. I., Concrete Coal Bin, Aug. 14
Aug. 24. Bremerton, Wash., Concrete Quay Wall, July 24
Aug. 24. Toledo, O., Monument, July 31
Aug. 26. Jacksonville, Fla., Jetty Work, Aug. 7
Aug. 26. Jacksonville, Fla., Jetty Works, Aug. 14
Aug. 26. Detroit, Mich., Lumber, Aug. 14
Aug. 26. West Point, N. Y., Street Lighting System, Aug. 14
Aug. 27. St. Peter's Bay, P. E. I., Breakwater, Aug. 14
Aug. 27. Cincinnati, O., Tracks, Grading, Etc., July 31
Aug. 29. Fort Lawton., Wash, Corrals, Aug. 14
Aug. 30. Philadelphia, Pa., Suction Dredges, Aug. 7
Aug. 31. Galveston, Tex., Jetty Work, Aug. 7
Aug. 31. Lebanon, Pa., Street Lighting, July 24
Sept. 1. Webb City, Mo., Railroad, July 31
Sept. 3. Winnipeg, Man., Hydro-Electric Development, June 19
Sept. 3. Two Rivers, Wis., Pier Work, Aug. 14
Sept. 4. Providence, R. I., Dredging, Aug. 14
Sept. 10. Fairport, O., Breakwater, Aug. 14
Sept. 10. Cleveland, O., Breakwater, Aug. 14
Sept. 30. Washington, D. C., Search Light Outfit, Aug. 7
Oct 5. Franklin Shoals, Ark., Lock and Dam, Aug. 7
Oct. 5. Mobile, Ala., Locks and Dams, Aug. 14
Oct. 5. Franklin., Ark., Aug. 14
Oct. 5. Vicksburg, Miss., Lock and Dam, Aug. 14

Excavation, Earth and Rock.

Aug. 15. Cheboygan, Mich., Dredging, July 24
Aug. 15. Mason City, Ia., Drain, Aug. 7
Aug. 16. Brooklyn, N. Y., Filling, Aug. 7
Aug. 16. New York, N. Y., Filling, Aug. 7
Aug. 16. Tampa, Fla., Dredging, July 24
Aug. 16. Boston, Mass., Dredging, Aug. 14
Aug. 19. New London, Conn., Dredging, July 31
Aug. 20. Charleston, S. C., Dredging, Aug. 7
Aug. 20. Weymouth, Mass., Dredging, Aug. 7
Aug. 20. Ivanhoe, Minn., Dredging, Aug. 14
Aug. 22. Brunswick, Ga., Dredging, July 24
Aug. 23. Savannah, Ga., Dredging, July 31
Aug. 26. Fort Washington, Md., Grading, Draining, July 31
Aug. 26. New York, N. Y., Embankment, July 31
Aug. 26. Block Island, R. I., Dredging, Aug. 7
Aug. 26. National Soldiers' Home, Va., Filling, Aug. 14
Aug. 26. Detroit, Mich., Hire of Plant, Aug. 14
Aug. 26. North Chicago, Ill., Grading, Aug. 14
Aug. 30. Portland, Me., Rock Excavation, Aug. 7
Sept. 2. Tacoma, Wash., Dredging, Aug. 7
Sept. 3. Ft. Snelling, Minn., Ditch Work, Aug. 14
Sept. 4. Providence R. I., Dredging, Aug. 7
Sept. 4. Norfolk, Va., Dredging, Aug. 14
Sept. 4. Providence, R. I., Dredging, Aug. 14
Sept. 5. Seattle, Wash., Dredging, Aug. 14
Sept. 10, Sibley, Ia., Ditch Work, July 31

Materials, Machines, Supplies, Tools Etc

Aug. 14. Washington, D. C., Track Scales, Tanks, Etc., July 31
Aug. 14. Washington, D. C., Elevators, July 31
Aug. 14. Wheeling, W. Va., Iron and Steel, July 24
Aug. 14. West Hoboken, N. J., Street Signs, Aug. 7
Aug. 15. New York, N. Y., Lumber, Aug. 7
Aug. 16. Chicago, Ill., Machinery, July 24
Aug. 19. West Point, N. Y., Lamp Posts, Lanterns, Aug. 7
Aug. 20. Mare Island, Cal., Brick, Timber, Etc., July 31
Aug. 20. Dallas, Texas., Waterpipe, Aug. 14
Aug. 20. New York, N. Y., Blocks, Pipe, Meters, Aug. 14
Aug. 20. Portsmouth, N. H., Cement, Pipe, Etc., Aug. 14
Aug. 20. Annapolis, Md., Pumps, Cement, Etc, Aug. 14
Aug. 20. Boston, Mass., Blocks and Tackle, Etc., Aug. 14
Aug. 20. Washington, D. C., Rope, Timber, Etc., Aug. 14
Aug. 21, Tompkinsville, N. Y., Moorings, July 31
Aug. 22. Tompkinsville, N. Y., Lantern, Aug. 7
Aug. 22. Washington, D. C., Engine, Tank, Etc., Aug. 7
Aug. 22. Philadelphia, Pa., Special Castings, Aug. 14
Aug. 23. Newark, N. J., Electric Equipment, Aug. 7
Aug. 26. Washington, D. C., Steel Barges, Etc., Aug. 14
Aug. 26. Detroit, Mich., Fir Timber, Aug. 7
Aug. 29. San Francisco, Cal., Motors, Chain Drives, Etc., Aug. 7
Sept. 3. Kansas City, Mo., Pipe and Specials, Aug. 7
Sept. 3. Kansas City, Mo., Steel Pipe, Aug. 7
Sept. 3. Puget Sound, Wash., Piles, Timber, Etc., Aug. 14
Sept. 3. Mare Island, Cal., Pipe, Lamps, Valves, Etc., Aug. 14
Sept, 8, Louisville, Ky., Pumping Engines, July 31
Sept. 14. Manila, P. I., Valves, Gates, July 31

BIDS ASKED.

Bridges.

Items Arranged Alphabetically by States.

Los Angeles, Cal.—Bids are asked by County Supervisors, C. G. Keyes, Clerk, until 2 p. m., Aug. 19, for furnishing labor and materials for construction of two concrete abutments and the erection of a timber bridge on said abutments, across the Dalton Wash, on Azusa Ave., Azusa Road District. The bridge to be so erected is the property of the county of Los Angeles and is now located at Alhambra.

Madera, Cal.—Bids are asked by the Board of Supervisors, W. R. Curtin, Clerk, until 10 a. m., Sept. 16, for constructing bridge across Horace Gold Creek.

Redwood City, Cal.—Bids are asked by the Board of Supervisors, Joseph H. Nash, Clerk, until 10 a. m., Aug. 19, for constructing wooden bridge across Tunitas Creek.

Plaquemine, La.—Bids are asked by the Bridge Commission of Iberville Parish until noon, Sept. 9, at offices of Police Jury Plaquemine, of which Jules A. Herbert is Clerk, for constructing approaches and steel draw bridge over Bayou Plaquemine.

Andover, O.—It is stated bids are asked by P. C. Remick, County Auditor, until Aug. 19, for constructing a reinforced concrete bridge.

Cincinnati, O.—Bids are asked by the Board of Public Service until 12 noon, Aug. 16, for reconstruction and repair of Liberty St. viaduct and approaches, from Garrard to State Aves. M. J. Keefe is Clerk Board of Public Service. Charles N. Dannenhower is Chief Engineer.

Cleveland, O.—Bids are asked by A. R. Callow, Secretary Board of Public Service, 105 City Hall, until noon, Aug. 21, for furnishing all labor and material and constructing complete ready for the pavement the steel superstructure of a viaduct on Kinsman Road S. E. over the Pennsylvania R. R. Certified check for $5,000 required with bid.

Columbus, O.—Bids are asked by the County Commissioners until Sept. 4 for all labor and material necessary to build, construct and complete the following work: Engineer's estimate No. 818.—Superstructure and roadway construction of the Holt bridge in Franklin Township. Engineer's estimate No. 819.—Concrete encasing of the pier of the Chenoweth Mill Bridge in Pleasant Township. Engineer's estimate No. 820.—Hauling and spreading furnace slag on the east approach of the Clickenger bridge in Hamilton Township. Blue print copies may be obtained of the County Surveyor at $1. Other plans for the construction of the superstructure and roadway construction of the Holt bridge are also invited.

Lima, O.—Bids are asked by Commissioners of Allen County until noon, Aug. 31, for building of the Adgate steel bridge, Shawnee township, the Morgan steel bridge, Sugar Creek township; also concrete abutments for said bridges, according to plans and specifications on file at the Commissioners' or Surveyor's offices, Lima, Ohio.

Logan, O.—Bids are asked by Board County Commissioners until Aug. 15 for constructing concrete or stone abutments for the Young's Ford Bridge. Jas. L. Martin, County Auditor.

Port Clinton, O.—Bids are asked until Aug. 17 by the Board of County Commissioners for furnishing material and constructing superstructure and substructure for bridge to have 65-ft. span, 16-ft. roadway across Crane Creek, Allen Township. Henry Pafenbach is County Auditor.

Urbana, O.—Bids are asked until Aug. 19 for building bridge on Kiser Road, Johnson and Rush Townships. C. E. Russell is County Auditor.

Youngstown, O.—Bids are asked until Aug. 19 by the Board County Commissioners for constructing a riveted highway bridge over Beaver Creek in Goslien Township. W. B. Jones, County Auditor.

Emporium, Pa.—Bids are asked until Aug. 20 by the Board County Commissioners, for constructing the substructure and superstructure of a highway bridge in Shippen Township. J. W. Lewis is Chmn of the Board.

Bloomsburg, Pa.—Bids are asked by the Commissioners of Columbia County, until Aug. 22 for constructing bridge over Raven Creek in Benton Township, and bridge over Chillisquaqua Creek in Madison Township.

Towanda, Pa.—Bids are asked by the County Commissioners, E. D. Harkness, Chairman, until Aug. 15, for constructing a bridge at James St. across Susquehanna River between Wysox and North Towanda Townships.

Ft. Myer, Va.—Bids are asked by Maj. Gray Zalinski, Q. M., U. S. A., Washington, D. C., until Aug. 20, for constructing bridge on Military Road, to Ft. Myer, Va.

Pateros, Wash.—Bids are asked by the State Highway Board, at Olympia, until Aug. 16, for constructing wagon bridge across Methow River at State Road No. 10.

Fond du Lac, Wis.—Bids are asked by J. F. Hohensee, City Clerk, until 2 p. m., Aug. 16, for removing the present Johnson St. bridge, and placing same across the river at Grove St., according to specifications on file in the Clerk's office.

Buildings.

Items Arranged Alphabetically by States.

Huntsville, Ala.—Bids are asked by E. G. Foster, Chmn. Bldg. Co., until Aug. 17, for the erection of a 2-story jail and jailer's residence for Scott County. J. G. Barnwell, Chattanooga, Tenn., is Architect.

Fort Smith, Ark.—Bids are asked by C. D. Mowen, Secretary Fort Smith Hotel Co., until noon, Aug. 28, for the erection of a 6-story, 160-room, reinforced concrete hotel building. Bids are desired for the entire work except heating and plumbing and mechanical appliances. Plans, etc., at office of H. E. Hewitt, Architect, 22 Arcade Bldg., Peoria, Ill., and at the office of the Kelly Trust Co., Ft. Smith, Ark.

Eureka, Cal.—Bids are asked until 10 a. m., Sept. 11, by George W. Cousins, Clerk of the Board of Supervisors of Humboldt County, for the contruction of a county jail building.

San Francisco, Cal.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Sept. 17, for the repairs to stonework, miscellaneous repairs, alterations and painting at the U. S. Mint Building, San Francisco.

Washington Barracks, D. C.—Bids are asked, until Sept. 3, by Maj. W. C. Lanagfitt, Corps. Engrs., U. S. A., Washington Barracks, for constructing 2 double sets of non-commissioned officers' quarters at Washington Barracks.

Moscow, Ida.—Bids are asked by the Board of Regents, until 2 p. m., Aug. 30, for the construction of a 3-story administration building at Moscow for the University of Idaho. The building will be 80x238 ft., of metal, stone and brick construction, and must be complete by Sept. 1, 1908. Former bids for this work were rejected, the lowest being Campbell Bros., Salt Lake City, Utah, $291,500. Mrs. S. H. Hays is Secretary Board of Regents.

Chambersburg, Pa.—Bids are asked by the County Commissioners, R. C. Prather, Clerk, until 11 a. m., Aug. 22, for the erection of a covered wooden bridge over the west branch of the Conococheague Creek in Metal Township, at Kegerrel's Fording; clear space of bridge 130 ft., clear roadway 14 ft. Bids are also asked at same time and place for the erection of a reinforced concrete 3-arch bridge at same location as above. Certified check for $350 must be filed with the County Commissioners not later than 11 a. m., Aug. 22.

Decatur, Ill.—Bids are asked until Aug. 18 by E. R. Wright, Secy. Pythian Home Bd., Taylorville, for furnishing material and erecting Illinois Pythian Home at Decatur. Bids to be submitted on the following: General contract, ventilating and heating, plumbing, sewerage and gas fitting, electric work. Plans and specifications may be had from Deal & Ginzel, Architects, Lincoln, upon a deposit of $10.

Peru, Ind.—It is reported bids are asked by the Board of Commissioners, until Aug. 29, for the construction of a cottage at the Lafayette State Soldiers' Home.

Cedar Rapids, Ia.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Sept. 23, for the construction (except elevator), of an extension, remodeling, etc., to the U. S. Post Office and Court House at Cedar Rapids.

Ames, Ia.—Bids are asked by E. W. Stanton, Secretary Board of Trustees of the Iowa State College, until 2 p. m., Aug. 21, for poultry and dairy farm buildings, plans and specifications for which may be seen at the office of the secretary and at the office of Proudfoot & Bird, architects, 625 Flynn Building, Des Moines, Ia.

Muscatine, Ia.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Sept. 19, for the construction complete of the U. S. Post Office at Muscatine.

Anthony, Kans.—Bids are asked, until Aug. 28, by the Bd. Co. Comrs., Henry Krider, Chmn., for the erection of a Court House on Court House Sq. Plans and specifications may be had for $15, of which $5 will be returned. Geo. P. Washburn & Son, Ottawa, Kan., are Architects. R. P. Chevraux is Co. Clk.

Portland, Me.—Bids are asked until Aug. 23 by the Committee on Public Buildings, Nathan Clifford, Chmn., for the masonry and carpentry for the new Durham St. school. John Calvin Stevens and John Howard Stevens, Orford Bldg., are Architects.

Boston, Mass.—Bids are asked until Aug. 15 by the Board of Park Commissioners, Charles E. Stratton, Chmn., 64 Pemberton Sq., for erecting a shelter in Marine Park on the Iron Pier.

Springfield, Mass.—Bids are asked until Aug. 15 by the Committee on City Property, A. F. H. Pittsburg, Chmn., for erecting an addition to Howard St. school. Kirkham & Parlett, 25 Harrison Ave., are Architects. Separate bids will be received for plumbing; also for installing a ventilating and heating system.

Howell, Mich.—Bids are asked by Dr. Henry J. Hartz, Secretary, 27 Adams Ave., East, Detroit, until Aug. 15, for furnishing material and erecting complete a main sanatorium, administration building and connections, and a wing to same; also for dining-room extension to present building, to be erected on the grounds in the vicinity of Howell. Bids are to be made as follows: 1, for general construction, including main administration building and connections, and wing and dining-room extension complete; 2, separate proposals for main administration building and connections complete, exclusive of wing and dining-room extension; 3, separate proposals for dining-room extension complete; 4, plans and bids for sewage disposal purification plant.

Kalkaska, Mich.—Bids are asked until Aug. 15 by the County Clerk for erecting a jail and sheriff's residence. Jacob N. Wolfe is Chmn. Bldg. Com.

Negaunee, Mich.—Bids are asked until Aug. 22 by Cyrille Houle, Secretary School Board, for erecting a high school. Plans and specifications may be had upon a deposit of $10. John D. Chubb, 112 Clark St., Chicago, Ill., is Architect. Separate bids will be received for plumbing, sewerage and gas fitting for above school.

Republlic, Mich.—Bids are asked until Aug. 26 by the Board of Education, Peter W. Pascoe, Secretary, for erecting a high and grade school. Charlton & Kuenzli, Marquette, Mich., are Architects.

Newberry, Mich.—Bids are asked by Board of Trustees of the Upper Peninsular Hospital for the Insane, Newberry, Mich. (Dr. E. H. Campbell, Secretary), until Aug. 20, for the erection and completion of the administration building, one cottage, and two cloister connections. Charlton & Keunzli, Architects, Marquette, Mich., and Milwaukee, Wis.

Ellendale, N. D.—Separate bids are asked by E. F. Bodle, President Board of Trustees, until Aug. 20, for installing a heating and plumbing system in dormitory building of state industrial school.

Cleveland, O.—Bids are asked by A. R. Callow, Secretary Board of Public Service, 105 City Hall, until noon, Aug. 28, for furnishing all material and labor for the excavations, foundations and superstructure for a market house on the land owned by the city at the northeast corner of West 25th St. and Lorain Ave. Certified check for $4,000 required with bid.

Cleveland, O.—Bids are asked by Board of Education, E. 6th St., Cleveland, until noon, Sept. 3, for furnishing all the material and for doing all the work necessary to complete an annex to Milford school, in accordance with the plans and specifications to be on file in the office of the architect, E. 6th St.

Columbus Grove, O.—Bids are asked until Aug. 17 by the Village Council for heating and plumbing the new city building. Harry F. Busche, Vil. Clk.

Nework, O.—Bids are asked until Aug. 19 by the Board of Education, D. M. Keller, Clk., for furnishing and installing a ventilating and heating system in the new high school annex, and changing heating system in the old building. Vernon Redding, Mansfield, O., is architect.

Toledo, O.—Bids are asked until Aug. 20 for furnishing material and erecting a school, including all plumbing and drainage, electric wiring and the heating and ventilation at the County Children's Home. Bacon & Huber, 755 The Spitzer Bldg., are Architects. D. T. Davies, Jr., is County Auditor.

Portland, Ore.—Bids will be received until Aug. 28 by the County Clerk for improvments and alterations on the Multnomah County armory at 10th and Church Sts. Richard Martin, Jr., Dekum Bldg., is Architect.

Wilkinsburg, Pa.—Bids are asked until Aug. 15 for erecting a 4-story addition to the Columbia Hospital. Estimated côst. $80,000. John L. Beatty, Pittsburg, Pa., is Architect.

Vermilion, S. D.—Bids are asked until Aug. 20 by the Regents of Education, Irwin D. Aldrich, Secretary, care of Cataract Hotel, Sioux Falls, for steam heating in the addition to East Hall at the State University at Vermilion. Jos. Schwarz, Sioux Falls, S. D., is Architect.

Maynooth, Ont.—Bids are asked until noon, Aug. 15, for constructing a concrete station and platforms, at Maynooth, for the Central Ontario Ry. Co. Geo. Collins, Manager, Trenton, Ont.

Roads and Streets

(Items Arranged Alphabetically by States.)

Jacksonville, Fla.—Bids are asked until 2:30 p. m., Aug. 26, by the Board of Public Works, for paving with brick Adams St., from Stuart St. to Myrtle Ave. The work includes grading about 6,060 sq. yds., laying 2,576 lin. ft. stone curbing, paving, etc. Philip Prioleau is City Engineer.

New Haven, Conn.—Bids are asked until Aug. 19 by C. W. Kelly, City Engr., for constructing a crushed stone pavement on Carlisle St., a bitulithic pavement on State St., and a Hassam pavement on Oak St.

Beardstown, Ill.—Bids are asked until Sept. 3 by A. G. Smith, City Clerk, for laying 38,460 sq. yds. brick pavement on concrete base. Estimated cost, $81,528. C. W. Brown, of Jacksonville, is Engineer.

Bloomington, Ill.—Bids are asked by E. F. Fauntz, City Engr., until Aug. 15 for 4,000 sq. yds. brick pavement on 4-in. concrete base, 3,000 ft. curb and gutter and 3,500 ft. 12, 15 and 18-in., pipe sewer.

Cairo, Ill.—Bids are asked until Aug. 15, by the Board of Local Improvements for laying 51,646 sq. yds. brick pavement on Washington Ave. Wilbur B. Thistlewood is City Engineer.

Bedford, Ind.—Bids are asked until 1 p. m., Aug. 17, by the County Commissioners for construction of 8,217 ft. of macadamized road. W. G. Owens is County Auditor.

Covington, Ind.—Bids are asked until 1:30 p. m., Aug. 16, by the County Commissioners for constructing the Glascock gravel road, 11,820 ft. in length. Wm. B. Gray is County Auditor.

Frankfort, Ind.—Bids are asked by Commissioners of Clinton County, at Frankfort, until 2 p. m., Aug. 27, for the construction of ten gravel roads of a total length of 20 miles. Charles F. Cromwell, County Auditor.

Sullivan, Ind.—Bids are asked by Council of Sullivan, until 10 a. m., Aug. 23, for the construction of brick streets. Estimated cost is $45,000.

Terre Haute, Ind.—Bids are asked until 11 a. m., Aug. 17, by the County Commissioners, for construction of 4,730 ft. of gravel road in Otter Creek Township Jerome W. Denehie is County Auditor.

Tipton, Ind.—Bids are asked by Commissioners of Tipton County, at Tipton, until 10 a. m., Aug. 19, for the construction of a gravel road on line between Tipton and Clinton Counties. J. F. Barlow is Auditor Tipton County.

Tipton, Ind.—Bids are asked by the Commissioners of Tipton County, at Tipton, until 9 a. m., Aug. 30, for the construction of gravel roads in Cicero, Jefferson and Wildcat Townships; 40 roads in all. J. F. Barlow, Auditor.

Valparaiso, Ind.—Bids are asked by Common Council of Valparaiso, until 8 p. m., Aug. 23, for the improvement of four streets, by paving with vitrified blocks. Robert B. Ewing is City Clerk.

Winchester, Ind.—Bids are asked by Council of Winchester until 8 p. m., Aug. 21, for the improvement of Oak St., with crushed stone.

Dundee, Mich.—Bids are asked by the Council until Aug. 20 for about 13,000 sq. yds. brick pavement and necessary curbing and drainage. The Riggs & Sherman Co., of Toledo, O., are the engineers.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., Aug. 22, for constructing brick or brick block pavement on the following alleys: On the alley between Oak St. and Locust St., from Irving Pl.; on the alley between McGee St. and Oak St., from 13th St. to 14th St.; on the alley between 26th St. and Matthews Ave., from Walrond Ave. to College Ave.; on the alley between Washington St. and Broadway from a point 144 ft. south of 10th St. to 11th St.; on the alley between Main St. and Walnut St., from a point 47 ft. south of the south line of 11th St., to the north curb line of 12th St. Cash deposit of $200 must be made with City Comptroller and certificate must accompany bid.

Kansas City, Mo.—Bids are asked by E. R. Harper, City Engineer, until 11 a. m., Aug. 22, for furnishing all materials and doing all work necessary to complete the following city improvements: Grading Woodland Ave. from the south line of 47th St., or Swope Park Blvd., to Southern City Limits; grading Chelsea Ave. from 20th St. to 24th St. or Westport and Independence Road; grading Monroe Ave. from 23d St. to 24th St.; grading Bennington Ave. from the south line of Washington Park Blvd., east of Bennington Ave. to the north line of Independence Ave.; grading Bellaire Ave. from Saida Ave. to St. John Ave.; grading Cambridge Ave. from Washington Park Blvd. to Independence Ave.; grading Winchester Ave. from 7th St. to 12th St.; grading 7th St. from Cambridge Ave. to Winchester Ave.; grading Fremont av. from Independence Ave. to 8th St.; grading Mercier St. from 41st St. to 43d St.; grading the alley between 8th St. and 9th St. from Woodland Ave. to Euclid Ave.; grading the alley between Benton Blvd. and Agnes Ave., from Howard St. to 25th St.; grading the alley between 9th St. and 10th St., from The Paseo to Vine St.; grading the alley next south of 14th St. from Baltimore Ave. to the alley east of Baltimore Ave.; grading the alley between 12th St. and 13th St., from Wyandotte St. to Baltimore Ave. Bond for $200 must accompany bid.

Marshfield, Mo.—Bids are asked until Aug. 30, by W. P. McKnight, City Clerk, for constructing about 98,000 ft. of macadam pavement and 7,200 ft. of stone guttering.

Pembroke, N. H.—Bids are asked until 5 p. m., Aug. 10, by the State Highway Department for the construction of 4,500 ft gravel road. A. W. Dean, at Concord, is State Engr.

Elizabeth, N. J.—Bids are asked by the City Council until Aug. 20 for paving Court St. and Waverly Pl. and flagging 7th St. The work includes 3,230 sq. yds. trap block pavement, 1,480 sq. yds. telford pavement, 1,720 lin. ft. new flag, 2,340 lin. ft. new curb, 1,390 sq. yds. trap block gutters, etc. Wm. H. Luster is City Surveyor.

Etna, N. J.—Bids are asked until 8 p. m., Aug. 23, for building a macadam road in Etna Borough. H. G. Hering, Borough Engineer, Hillsdale, N. J. Charles J. Miller, Mayor.

Hoboken, N. J.—Bids are asked until 8 p. m., Aug. 28, by the City Council, for repaving portions of Third and Grand Sts. James H. Londrigan is City Clerk.

Wildwood, N. J.—Bids are asked until noon, Aug. 20, by the Street Commission, Evans G. Slaughter, Chairman, for laying about 40,000 sq. yds. macadam pavement. curbs, etc. L. M. Rice is Borough Engineer.

Woodcliff, N. J.—Bids are asked until 8 p. m., Aug. 20, by the Borough Council, for macadamizing portion of Mill Road and Pascack Road, Woodcliff Heights Road and Glen Road, a distance of 12,849 ft. H. G. Hering, Jr., is Borough Engineer.

Albany, N. Y.—Bids are asked until noon, Sept. 3-4-5, by Frederick Skene, State Engr., for constructing various state roads.

Brooklyn, N. Y.—Bids are asked until Aug. 21 by Bird S. Coler, Borough President, for paving and repairing portions of Bushwick and Denton Pa., Driggs and Morgan Aves., Bœrum, Box, Dupont, Eagle, Granite and Guernsey Sts., laying sidewalks on 87th and 71st Sts., and constructing cement concrete sidewalks on various streets. Engineer's estimate: 24,345 sq. yds. asphalt pavement, 2,330 sq. yds. iron slag blk. pavement, with cement joints, 2,320 sq. yds. granite blk. pavement with tar and gravel joints, 2,940 sq. yds. medina sandstone pavement, with cement joints, 24,900 sq. ft. cement sidewalks, 97,488 sq. ft. cement concrete sidewalk, 4,471 cu. yds. concrete, 18,660 lin. ft. new curbs, etc.

Geneva, N. Y.—Bids are asked until 2 p. m., Aug. 15, for grading Roosevelt St., Torrey and Bell Aves. C. T. Church is City Engr.

Long Island City, L. I., N. Y.—Bids are asked by Jos. Bermel, Borough President, until Aug. 15, for regulating and grading the Boulevard from Webster Ave. to Broadway. Engineer's estimate: 550 cu. yds. of rock excavation, 4,866 cu. yds. earth excavation, 300 lin. ft. 24-in. iron drain pipe in place; also same time and placing for furnishing and delivering to the Bureau of Highways, Borough of Queens, 3,500 broken stone of trap rock, size, 1¼ in., and 1,500 cu. yds. trap rock screenings.

New York, N. Y.—Bids are asked until noon, Aug. 19, by the Dept. of Docks and Ferries, J. A. Bensel, Comr., for furnishing and placing riprap stone.

New York, N. Y.—Bids are asked until noon, Aug. 19, for building pedestrian approaches to the ferries between West 22d and West 23d Sts., North River, and granite pavement between West 13th and West 14th Sts., North River, on the Chelsea Section, Borough of Manhattan.

New York, N. Y.—Bids are asked until 11 a. m., Aug. 21, by Bird S. Coler, President Borough of Brooklyn, for regulating paving, etc., portions of various streets, Borough of Brooklyn.

Syracuse, N. Y.—Bids are asked by Board of Contract and Supply, George J. Metz, City Clerk, until 1:30 p. m., Aug. 19, for furnishing material and constructing a number of stone, cement, asphalt or brick sidewalks.

Mt. Gilead, O.—It is stated that bids are asked until Aug. 23 by W. C. McFarland, County Auditor, for constructing the Climax Free Turnpike.

Sandusky, O.—Bids are asked until Aug. 20 by B. J. McGory, Clerk Board Public Service, for grading, curbing and paving portions of Osborne, Lawrence, Washington and Monroe Sts.

Toledo, O.—Bids are asked by the Board of County Commissioners until 10 a. m., Aug. 19, for grading, draining and macadamizing. D. T. Davis, Jr., is County Auditor.

Smethport, Pa.—Bids are asked by W. G. Holder, Town Clerk, until Aug. 29 for about 22,056 sq. yds. paving.

Aberdeen, Wash.—Bids are asked until 6 p. m., Aug. 21, by the City Council, for paving, grading, etc., portions of various streets. P. F. Clark is City Clerk. H. W. Troutman is City Engineer.

Olympia, Wash.—Bids are asked until 2 p. m., Aug. 16, by the State Highway Board, Joseph M. Snow, Secretary, for grading, etc., portion of state road No. 3.

Jonesville, Wis.—It is stated that bids are asked until Aug. 23 by the Street Assessment Committee, S. B. Heddles, Chmn., for paving with macadam, a portion of St. Lawrence Ave.

Milwaukee, Wis.—Bids are asked by Board Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., Aug. 16, for constructing granite block pavement on St. Paul Ave. Certified check for $2,400 required with bid.

Oshkosh, Wis.—It is stated that bids are asked by the Board Public Works, until Aug. 17, for paving with asphalt a portion of Church St.

Watertown, Wis.—Bids are asked until 10 a. m., Aug. 24, by the Board of Public Works for grading portions of Dewey Ave. and Division St. Gustav Glaser is St. Comr., Board Public Works. E. B. Parsons is City Engineer.

Sewers.

Items Arranged Alphabetically by States.

Fort Dade, (P. O. Egmont), Fla.—Bids are asked by Lieut. J. A. Thomas, Constructing Q. M., until 7 p. m., Aug. 30, for construction of storm water drains at this post.

Evansville, Ind.—Bids are asked by Department Public Works, Walter F. Wunderlich, Clerk, until 2 p. m., Aug. 17, for constructing local sewer in alley in Block 96.

West Lafayette, Ind.—Bids are asked by Charles T. Stallard, Town Clerk, until 7:30 p. m., Aug. 19, for constructing 12 in. vitrified sewer in Vine St., and 8 in. vitrified pipe sewers in a number of other streets.

Louisville, Ky.—Bids are asked by the Commissioners of Sewerage, until noon, Aug. 28, for constructing Happy Hollow sewer. Harrison P. Eddy, Consulting Engineer, 14 Beacon St., Boston.

Athol, Mass.—Bids are asked until Aug. 20 by the Sewer Commissioners, Herbert L. Hapgood, Chairman, for the construction of about 8,500 ft. of sewers.

St. Paul, Minn.—Bids are asked by Board of Public Works, R. L. Gorman, Clerk, until 2 p. m., Aug. 19, for constructing sewer in Franklin St., from Eustis St. to Raymond Ave.

Winnebago, Minn.—Bids will be received until Aug. 15 by the Village Council for constructing sewers with manholes. J. H. Ferin, is Village Clerk.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., Aug. 22, for furnishing all material and doing all work necessary to complete the following city improvements: Constructing Joint district sewers in Joint Sewer District Numbers 89, 157, 158, 159, 160, 161, 162, 163, 175, 208, 209, 212, 217, 218, 219, 247, 248, 280, 283 and 294, in sewer division Number 3, as provided by ordinance No. 34936. No proposal will be considered unless a cash deposit of $200 has been previously made with the City Comptroller and certificate thereof accompanies the bid.

Nevada, Mo.—Bids are asked by S. L. Higgins, City Clerk, until 4 p. m., Aug. 20, for construction of District Sewer No. 14.

Lewistown, Mont.—Bids are asked until 8:30 p. m., Aug. 14, by the City Council, for constructing sewer. M. D. Kimball is City Clerk.

Pembroke, N. H.—Bids are asked until Aug. 19 by A. W. Dean, State Engineer, Concord, for grading and surfacing with gravel about 5,000 ft. of Merrimac Valley road, in Pembroke.

Elizabeth, N. J.—Bids are asked by the City Council, until Aug. 15, for furnishing material and constructing sewers in Second and Fourth Aves., and Christine and John Sts. About 3,057 lin. ft. 15, 12, 10 and 6-in. pipe, etc., is included in this work. N. K. Thompson is St. Commissioner.

Hackensack, N. J.—Bids are asked by the Hackensack Improvement Commission until Aug. 20 for the construction of a concrete drain to connect the brook with the sewer in Union St., together with wing walls, air flap, guard rails, etc. Lemuel Lozier is Engineer, Bank Bldg.

Newark, N. J.—Bids are asked by the Board Street and Water Commissioners until Aug. 15, for constructing the Tyler St. sewers and branches, requiring 3,780 ft. 12, 10 and 8-in. deep and wide socket pipe, 3,880 6-in. house connections, 17 manholes, etc., also constructing the N. 13th St. sewer, requiring 1,425 ft. 12 and 10-in. pipe, 280 ft. 6-in. house connections, 9 manholes, etc. M. R. Sherrerd is Chief Engineer.

West New York, N. J.—Bids are asked by James L. Wolfe, Town Clerk, until 8 p. m., Aug. 20, for the construction of an 18-in. and 20-in. vitrified pipe sewer in Hudson Ave., from 21st to 23d St., and for the construction of a 12-in. vitrified pipe sewer in Palisade Ave., from 22d to 23d St. All bids must be accompanied by a bond on a penal sum equal to amount of the bid.

Wildwood, N. J.—Bids are asked until noon, Aug. 20 by the Street Committee, Evans G. Slaughter, Chairman, for the reconstruction of about 12,000 lin. ft. sewers. L. M. Rice is Borough Engineer.

Long Island City, L. I., N. Y.—Bids are asked by Jas. Bermel, Borough President, until Aug. 15, for building a temporary sewer in Chestnut St. and Whitestone Ave. Engineer's estimate, 1,375 lin. ft. 12-in. Vitr. salt glazed or cement concrete pipe, sewer; 10 manholes, 10 M ft timber for bracing and sheet piling, etc.

New York, N. Y.—Bids are asked until 11 a. m., Aug. 14, by Bird S. Coler, President Borough of Brooklyn, for building sewers, etc., in various streets, Borough of Brooklyn.

Whitesboro, N. Y.—Bids are asked by the Board of Trustees, until Aug. 19, for rebuilding various portions of the sewerage system. J. C. Eberly, Jr., Village Clerk. W. G. Stone, C. E., Mann Bldg., Utica.

Canal Dover, O.—Bids are asked until Aug. 31 for the construction of a combined sewer system of sewer pipe; cost estimated at $18,037. Geo. E. Arnold, Engr., New Philadelphia, O.

Cleveland, O.—Bids are asked by A. R. Callow, Secretary of the Board of Public Service, 105 City Hall, until noon, Aug. 20, for the construction of sewers in portions of following avenues: Columbia Ave., N. E., 105th St. and Parkwood Drive, N. E.; Cypress Ave., W.; Cecelia Ave., S. W.; Clybourne Ave., S. W.; Dawning Ave., S. W.; Montclair Ave., S. W.; West 22d Pl.; Worley Ave., S. E.

Baden, Pa.—Bids are asked until 8 p. m., Aug. 26, by the Town Council, for constructing system of sanitary sewers. J. P. Leaf, Borough Engineer, Rochester, Pa.

Aberdeen, Wash.—Bids are asked by P. F. Clark, City Clerk, until 5 p. m., Aug. 21, for the construction of sewers in sewer districts C and D. Sewer consists of about five miles of vitrified clay sewer pipe from 6 in. to 24 in., with the necessary manholes, flush tanks, etc. H. W. Troutman, City Engineer.

Baraboo, Wis.—Bids are asked by this city until Aug. 15 for constructing 1,000 ft. of 36 in. concrete sewers. H. E. Frendi, City Engineer.

Elroy, Wis.—Bids are asked by J. M. Dix, City Clerk, until Aug. 31, for the construction of 6,643 ft. of 6 to 18-in pipe sewers. W. G. Kirchoffer, Engr., Madison.

Milwaukee, Wis.—Bids are asked by Board of Public Works, Charles J. Poetsch, Chairman, until 10:30 a. m., Aug. 16, for constructing following sewers: Pipe sewer in Hadley Ave., in Louis Ave. and Greenfield Ave.; brick and pipe sewers in Harrison St.

Water Supply

Items Arranged Alphabetically by States.

Victoria, B. C.—Bids are asked by Wm. W. Northcott, Purchasing Agent, until Sept. 3 for supplying 5,000 ft. of 6-in. and 15,000 ft. of 4-in. cast iron water pipe.

Fort Dade, (P. O. Egmont), Fla.—Bids are asked by Lieut. J. A. Thomas, Constructing Q. M., until 7 p. m., Aug. 30, for constructing 150,000-gallon steel tank and trestle and ice plant at this post.

Geneseo, Ill.—Bids are asked until Aug. 19 for pumping machinery. J. F. Lieberknect, City Clk.

Chicago, Ill.—Bids are asked by John J. Hanberg, Commissioner Public Works, until 11 a. m., Aug. 31, at room 224 City Hall, for furnishing and delivering to the city of Chicago, approximately: 800 1-in. meters, 500 1¼-in. meters, 500 1½-in. meters, 200 2-in. meters, 50 3-in. meters, 30 4-in. meters, 20 6-in. meters. Proposals must be accompanied with $2,300 in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago and made payable to the order of the Commissioner of Public Works.

Chicago, Ill.—Bids are asked by John J. Hanberg, Commissioner Public Works, until 11 a. m., Aug. 31, for furnishing all labor and material and doing all the work necessary to complete the construction of the Lawrence Ave. pumping station. Bids must be accompanied with $1,000 in money or certified check for the amount on some Chicago bank.

Chicago, Ill.—Bids are asked by John J. Hanberg, Commissioner Public Works, until 11 a. m., Aug. 3, for furnishing labor and material and for doing all the work of every sort and kind necessary to complete the construction of an intake tunnel for Lawrence Ave. conduit at Lawrence Ave. and Lake Michigan, being a portion of section N, intercepting sewers, according to plans and specifications on file in the office of the Department of Public Works of said city, room 221 City Hall. Proposals must be accompanied with ten thousand dollars in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago, and made payable to the order of the Commissioner of Public Works.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

Louisville, Ky.—Bids are asked by Board Public Works, Roger G. McGrath, Secretary, until noon, Aug. 20, for erecting 28 fire hydrants.

Cumberland, Md.—Bids are asked by the Board of Water Commissioners until Aug. 20 for furnishing and installing complete a pumping engine of 5,000,000 gal. capacity.

Westboro, Mass.—Bids are asked by George S. Adams, M. D., Superintendent Westboro Insane Asylum, until 11 a. m., Aug. 23, for laying about 3,880 ft. of 12-in. cast-iron water pipe from 9 to 13 ft. deep approximately, and other things pertaining thereto. Plans, etc., at the office of Engineer J. J. Van Valkenburgh, South Framingham, Mass.

Kansas City, Mo.—Bids are asked by Everett Elliott, Secy. Board of Public Works, until Sept. 3, for furnishing and delivering f. o. b. cars Kansas City, the following: 50 tons 4-in., 1,110 tons 6-in., 260 tons 8-in., 370 tons 10-in., 220 tons 12-in., 700 tons 16-in., and 20 tons each of 20, 24, 30, 36 and 42-in., cast iron pipe, also 2,200 tons 48-in. cast iron pipe and 50 tons special castings for pipe 24-in. and greater in diameter; also same time and place for 1,000 lin. ft. riveted steel pipe, having a minimum internal diameter of 48-in., made of soft steel place ½ in. thick; bids will also be received for furnishing 6,000 lin. ft. additional 48-in., steel riveted pipe.

Montreal, Que.—Bids are asked until noon, Sept. 6, for the construction of a reinforced concrete conduit, about 9 ft. in diameter and 27,300 ft. long. George Janin, Supt. and Chief Engineer, Water Works.

Homestead, Pa.—Bids are asked by the Borough Clerk, until Aug. 16, for furnishing cast iron pipe T's, stop gate valves, check valves and specials for a new water line; also distributing and laying cast iron pipe from 13th Ave. to new water tower at the reservoir; disconnecting the present 14-in. line and lowering part of the same and reconnecting to the new line and setting gates.

Philadelphia, Pa.—Bids are asked by George R. Stearns, Director Department Public Works, until noon, Aug. 20, for Contract No. 102—Preliminary Filters at Torresdale; Contract No. 108—Roxborough Pipe Extension System. Specifications, drawings and blank forms upon which bids must be made can be obtained from the Chief Engineer of the Bureau of Filtration, Room 712, City Hall, to whom all communications should be addressed.

Philadelphia, Pa.—Bids are asked until noon, Aug. 29, by the Bureau of Filtration, Dept. Public Works, for (Contract No. 110) electric machinery for Torresdale pumping station; and for (Contract No. 119) sand washer pumps for Torresdale filter plant. George R. Stearns, Director.

Lewisburg, Tenn.—Bids are asked by the Board of Mayor and Aldermen of the city until Aug. 20, for standpipe erected, foundation for same, cast iron water pipe, specials, hydrants, etc., in the construction of the water works in this city.

Excavation—Earth and Rock

Items Arranged Alphabetically by States.

North Chicago, Ill.—Grading—Bids are asked by Bureau of Navigation, Navy Department, Washington, D. C., until 12 noon, Aug. 26, for furnishing the labor and material necessary to complete work of grading at the naval training station, Great Lakes, North Chicago, Ill. Blank forms of proposals and specifications will be furnished, and plans may be procured upon application to the commandant, naval training station, Great Lakes, North Chicago, Ill.

Boston, Mass.—Dredging, Riprap—Bids are asked by Harbor and Land Commissioners, Room 131, State House, until 2 p. m., Aug. 16, for the dredging of about 20,000 cu. yds. of material, to form a new channel at the entrance to Scorton Harbor, and using about 7,500 cu. yds. of the excavated material to form a dike or dam to close the old outlet. In addition, the easterly bank of the new channel is to be protected by about 2,000 tons of stone riprap.

Ivanhoe, Minn.—Dredging.—Bids are asked for the excavating of 5 ditches. The aggregate estimated cost is $24,275. Some tile but mostly dredge work. Three of these are practically one ditch, and other two are within easy moving distance.

Detroit, Mich.—Hire of Plant—Bids are asked by Col. Chas. E. L. B. Davis, U. S. Engrs., Jones Bldg., until 3 p. m., Aug. 26, for hire of dredging plant for use in Detroit River.

Ft. Snelling, Minn.—Bids will be received until Sept. 3 by Major Amos W. Kimball, Constr., Q. M., U. S. A., St. Paul, for constructing a ditch at Ft. Snelling.

Providence, R. I.—Dredging.—Bids are asked by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., Newport, until Sept. 4 for dredging in Providence Harbor.

Norfolk, Va.—Dredging—Bids are asked by Major Jos. E. Kuhn, U. S. Engrs., Room 2, Custom House, until noon, Sept. 4, for dredging harbor at Norfolk, Va.

National Soldiers Home, Va.—Filling—Bids are asked by B. A. Beeson, Treasurer Southern Branch, N. H. D. V. S., until 1:30 p. m., Aug. 26, for 5,000 cu. yds. of filling behind Jones Creek revetment.

Seattle, Wash.—Dredging—Bids are asked by Major H. M. Chittenden, U. S. Engrs., 602 Burke Bldg., until noon, Sept. 5, for dredging Swinomish Slough, Wash.

Miscellaneous

Items Arranged Alphabetically by States.

Mobile, Ala.—Locks and Dams—Bids are asked by Major H. Jervey, U. S. Engrs., until 11 a. m., Oct. 5, for building locks and dams Nos. 2 and 3, and lock-tender's house, Tombigbee River, Ala.

Franklin, Ark.—Lock and Dam.—Bids are asked by Capt. G. M. Hoffman, Corps Engrs., U. S. A., Vicksburg, Miss., until Oct. 5, for building Lock and Dam No. 8 in Ouachita River at Franklin Shoals, Ark.

Jacksonville, Fla.—Jetty Work.—Bids are asked by Maj. Francis R. Shunk, Corps Engrs., U. S. A., until Aug. 26, for building jetties at Biscayne Bay., Fla.

Henry, Ill.—Separate bids will be received by the Building Committee, Peter Meridan, Secy., or Rev. L. Zumbuehl, until Aug. 16, for installing steam heating plant with pipes and radiators complete, in a brick church, 110x40 ft.; also electric wiring and furnishing and installing electric light fixtures in same.

Shawneetown, Ill.—Reinforcing Levee.—Bids are asked by Isham Randolph, Chmn. internal Improvements commission of Illinois, until 12 o'clock noon, Aug. 22, for all of the work of reinforcing the Shawneetown Levee. Advertisement appears elsewhere in Engineering-Contracting.

Ft. Leavenworth, Kan.—Bids are asked until Aug. 15 by Capt. J. E. Normoyle, Q. M. U. S. A., for electric wiring Sherman Hall and Annex at this post.

Boston, Mass.—Harbor Improvement.—Bids are asked until Aug. 16 at 2 p. m. by the Board of Harbor and Land Commissioners for improving the entrance to Scorton Harbor at East Sandwich. Frank W. Hodgdon is Chief Engineer.

Detroit, Mich.—Lumber.—Bids are asked until Aug. 6 2by Col. Chas. E. L. B. Davis Engrs., U. S. A., Detroit, for furnishing and delivering about 600 M. ft. timber at St. Marys Falls Canal.

Dawson, Minn.—The village of Dawson asks for bids on a combined water works and electric light plant until Aug. 20; estimated cost, $28,000. Engineer, Oscar Claussen, of St. Paul.

Vicksburg, Miss.—Lock and Dam.—Bids are asked until noon, Oct. 5, for building Lock and Dam No. 8, in Ouachita River at Franklin Shoals, Ark. Capt. G. M. Hoffman, Corps Engrs., U. S. A.

Newark, N. J.—Bids are asked until Aug. 23 by the Special Com. on Electric Lighting of the Common Council for furnishing and installing an electric light plant in City Hall to include the following: 3 engines and 3 electric generators, steam piping, etc., switchboard instruments, wiring, etc., foundations and masonry; entire equipment. Jas. M. Seymour, Consulting Engineer, 51-55 Lawrence St. Jas. F. Connelly, City Clerk.

Blackwell's Island, N. Y.—Bids are asked until Aug. 22 by Robert W. Hibberd, Commissioner Public Charities, New York City, for materials and labor required for complete conduiting, electric wiring, and all other work in connection with installation of a complete electric lighting and power system for all buildings and grounds under jurisdiction of Dept. of Public Charities, and comprising the New York City Home for Aged and Infirm, Blackwell's Island, Borough of Manhattan.

Brooklyn, N. Y.—Bids will be received by J. A. Bensel, Commissioner Docks, New York City, until Aug. 16 for furnishing material and placing filling in rear of ferry structures at 39th St., Borough Brooklyn, as per contract 1,088.

New York, N. Y.—Dock Work.—Bids are asked by J. A. Bensel, Commissioner Docks, until Aug. 19, for furnishing materials and putting in place rip-rap stone, as per Contract 1191.

New York, N. Y.—Bids are asked by J. A. Bensel, Commissioner Docks, until Aug. 21, for furnishing material and building freight sheds on Piers Nos. 60, 61 and 62, and on the adjacent bulkhead platforms or lateral extensions between W. 19th and W. 22nd Sts., on the North River, Borough Manhattan, as per Contract 1091.

New York, N. Y.—Bids are asked by John H. O'Brien, Commissioner Water Supply, Gas and Electricity, until 2 p. m., Aug. 15, for the following work:

For furnishing, installing, maintaining and reserving for the use of the high pressure fire service, all apparatus and equipment necessary for generating and transmitting 3,250 kilowatts of three phase, 6,600 volts, 25 cycle electric power, and furnishing and delivering this power, under the terms of this contract, to Aug. 15, 1908, at each of the high pressure fire service pumping stations, located in Borough of Manhattan, at Oliver and South Sts., and at Gansevoort and West Sts., respectively.

For furnishing, delivering and putting in place lanterns and burning appliances for changing the lamps in the 30th Ward, Borough of Brooklyn, from the present open-flame gas lamps to mantle gas lamps.

For furnishing, installing, maintaining and reserving for the use of the high pressure fire service all apparatus and equipment necessary for generating and transmitting 1,830 kilowatts of three phase, 6,600 volts, 25 cycle electric power, and furnishing and delivering this power under the terms of this contract to Aug. 15, 1908, at each of the high pressure fire service pumping stations, located in Borough of Brooklyn, at Furman and Joralemon Sts., and at Willoughby and St. Edwards Sts., respectively.

For furnishing electric current for lighting and power purposes to the equipment owned by the city now installed or to be installed on the Williamsburg Bridge, for the term of this contract, from Aug. 15, 1907, to Dec. 31, 1907, both inclusive, in Borough of Manhattan.

Stapleton, S. I., N. Y.—Bids will be received by J. A. Bensel, Commissioner of Docks, New York City, until Aug. 16, for furnishing materials and placing filling in the rear of the ferry structures at Canal St., Stapleton, Borough Richmond, as per contract 1,089.

West Point, N. Y.—Street Lighting System—Bids are asked by Quartermaster until noon, Aug. 26, for furnishing and installing an electrical distributing and street lighting system.

Cleveland, O. — Breakwater—Bids are asked by Lt.-Col. C. McD. Townsend, U. S. Engrs., 813 Prospect Ave., until 2 p. m., Sept. 10, for extension of east breakwater at Cleveland Harbor.

Fairport, O.—Breakwater—Bids are asked by Lt.-Col. C. McD. Townsend, U. S. Engrs., Cleveland, until 2 p. m., Sept. 10, for extension of west breakwater at Fairport Harbor.

Fort Greble, R. I.—Concrete Coal Bin—Bids are asked by Capt. Willis C. Metcalf, Constructing Quartermaster, 208 Thames St., Newport, R. I., until 10 a. m., Aug. 24, for construction of reinforced concrete coal bin at Fort Greble, R. I.

Fort Lawton, Wash.—Corrals—Bids are asked by Major W. S. Wood, Quartermaster, Seattle, Wash., until 11 a. m., Aug. 29, for new corrals and buildings for same at Fort Lawton.

Two Rivers, Wis.—Pier Work—Bids are asked by Major W. V. Judson, U. S. Engrs. Milwaukee, Wis., until 2 p. m., Sept. 3, for removing old pier, building pile pier, dredging, etc., at Two Rivers Harbor, Wis.

Campbellford, Ont.—Bids are asked until Aug. 15 by W. J. Doxsee, Mayor, for rock-cutting, concrete work, turbine wheels, generators, and about 2¼ miles of transmission line for power development at Middle Falls, on the Trent River. John S. Fielding, Consulting Engineer, 15 Toronto St., Toronto.

St. Peter's Bay, P. E. I.—Breakwater.—Bids are asked by Fred Gelinas, Secy. Dept. Public Works, Ottawa, Ont., until Aug. 27, for the construction of an extension to the breakwater at St. Peter's Bay, Kings County, P. E. I., according to a plan and specification to be seen at the office of J. B. Hegan, Resident Engineer, Charlottetown, P. E. I.

Materials, Machines, Supplies, Tools, Etc

(Items Arranged Alphabetically by States.)

Mare Island, Cal.—Pipe, Lamps, Valves, Etc.—Bids are asked by Bureau Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Sept. 3, to furnish at the navy yard, Mare Island, Cal., etc., a quantity of naval supplies, among which are the following: Schedule 144—Annealing furnace. Schedule 190—Oregon pine, redwood, lumber. Schedule 191—Soil pipe, pipe fittings, radiators and valves, plumbing fixtures. Schedule 192—Incandescent lamps, electric fixtures, glass, mastic roofing, brick, etc., calking lead, asbestos covering, range, locomotive boiler. Schedule 194—Steel nuts, steel and copper nails, spikes, differential blocks, hack-saw blades, paint torches, fire pots, hammer handles, drills, machinists' sets, pipe sets, shovels, squeegees, brass wire, hardware and tools. Schedule 195—Rolled bronze, brass rod, sheet brass, lead, and steel; ingot copper, bar iron, slab and sheet zinc. Schedule 198—Brass and steel pipe, pipe fittings, bibb cocks, valves, gauge glasses.

Washington, D. C.—Steel Barges—Bids are asked by D. W. Ross, General Purchasing Officer, Isthmian Canal Commission, until 10:30 a. m., Aug. 26, for furnishing under Circular 383, steel barges.

Washington, D. C.—Rope, Timber, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 20, to furnish at the navy yard, Washington, D. C., etc., a quantity of naval supplies, among which are the following: Schedule 167—Hardware, steel, piles, yellow pine. Schedule 173—Motor, starting panel, circuit breaker. Schedule 174—Steel-wire rope, steel forgings. Schedule 175—White and yellow pine. Schedule 184—Tool steel.

Boston, Mass.—Blocks and Tackle, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 20, to furnish supplies at the navy yard, Boston, Mass., as follows: Schedule 167—Covering hot water heating pipes. Schedule 178—Blocks and tackle, scales, pneumatic tools, mandrels for lathe, valve reseating machine, galvanized buckets, hardware and tools. Schedule 179—Drawing instruments, etc.

Annapolis, Md.—Pumps, Cement, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington D. C., until 10 a. m., Aug. 20, to furnish at the Naval Academy, Annapolis, Md., a quantity of naval supplies, among which are the following: Schedule 178—Duplex and boiler feed pumps, tools, etc. Schedule 179—Electrical instruments, fuel saving recorder, steam calorimeter. Schedule 180—Portland cement, bricks, gravel, sand, lime, tar paper, coal tar pitch. Schedule 181—Copper conductor, etc. Schedule 182—Brass and iron gate valves, rubber pump valves.

Portsmouth, N. H.—Cement, Pipe, Etc.—Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 20, to furnish at the navy yard, Portsmouth, N. H., a quantity of Portland cement, sand, steam pipe, pipe fittings, valves, asbestos pipe covering. Applications for proposals should refer to Schedule 167.

New York, N. Y.—Blocks, Pipe, Meters. —Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Aug. 20, to furnish at the navy yard, New York, N. Y., etc., a quantity of naval supplies, among which are the following: Schedule 143—Wireless telegraph apparatus. Schedule 169 —Platinum and bronze wire, insulators, porcelain tubes, resistances, telephone head gears, dry cells, electrolyte. Schedule 170 —Yacht blocks, nails, wire screens, hydrometers, hardware, iron pipe, pipe fittings, sewer pipe, plumbing fixtures. Schedule 171—Yellow pine, doors, etc., window and door screens. Schedule 172—Asbestos roofing, steel tower, mercury. Schedule 177—Water meters. Schedule 181—Portable voltmeters and ammeters. Schedule 182—Composition spikes, direct differential blocks, sewer pipe. Schedule 183—White ash, white cedar, white pine, spruce, yellow pine. Schedule 184—Sheet brass, steel beams.

Philadelphia, Pa.—Special Castings.—Bids are asked by George R. Stearns, Director Public Works, until noon, Aug. 22, for Contract No. 129—Furnishing Special Castings and Breeches Pipe for 1907. Specifications, drawings and blank forms upon which bids must be made can be obtained from the Chief Engineer of the Bureau of Filtration, Room 712, City Hall, to whom all communications should be addressed.

Dallas, Tex.—Water Pipe.—Bids are asked by this city, until Aug. 20, for furnishing 250 tons of 6 in. cast iron standard water mains. D. F. Sullivan is Waterworks and Sewerage Commissioner.

Puget Sound, Wash.—Piles, Timber, Etc. —Bids are asked by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 a. m., Sept. 3, to furnish at the navy yard, Puget Sound, Wash., a quantity of naval supplies, among which are the following: Schedule 189—Tools, creosoted piles, plumbing fixtures, gate valves, expansion traps. Schedule 193—Condenser tubes. Schedule 201—Incandescent lamps, electrical fittings, fir lumber.

CONTRACTS LET.

Items Arranged Alphabetically by States.

Pine Bluff, Ark.—Bridge. J. I. Boggs, Little Rock, Ark., has been awarded contract at $3,500, for constructing 220 ft. steel bridge over Bayou Bartholomew.

Pine Bluff, Ark.—Vitrified Brick Paving. —Shelby & Petty were awarded contract for laying 14 blocks of brick paving on East 2d Ave. The work will cost about $35,000.

Denver, Colo.—Bridges.—Contracts were awarded to the Canton Bridge Co., Canton, O., for erection of bridges over Clay Creek and Butte Creek, at a total cost of $1,977.

Washington, D. C.—Railway Buildings.—Edward Brady & Son have received the contract for the erection of large shop buildings, storehouse, power house, etc., to be erected near Union Station by the B. & O. R. R. Co.

Cordele, Ga.—Sewer System.—Sullivan & Lord, Birmingham, Ala., were awarded the contract at $36,000, for putting in a sewer system. Six months is allowed to complete the work.

Macon, Ga.—Railway Shops.—McKenzie-DeLeon Construction Co., Savannah, Ga., were awarded contract for erection of shop buildings for plant at Macon. Cost of buildings is reported as $1,500,000 and equipment one-third to one-half that amount.

West Point, Ga.—Railroad Construction. —Hardaway & Wright, Columbus, Ga., have been awarded the contract for construction of 20 miles for the Chattahoochee Valley Railway, with option for probable 12 additional miles, same rate.

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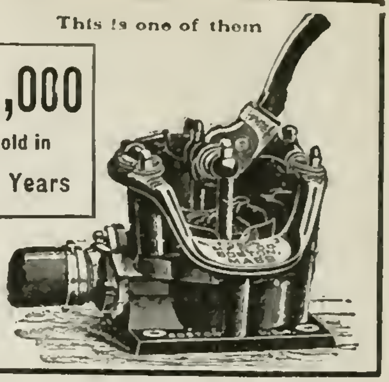

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150 Nassau St. NEW YORK, N. Y.

Substructure South Ashland Ave. Bridge, Department of Public Works.

Chicago, July 22, 1907.

Sealed Proposals will be received by the city of Chicago until 11 a. m., Saturday, August 17, 1907, at room 224 City Hall, for the furnishing, delivering and building in place all temporary work, and for furnishing all materials, tools, labor, and all appliances and appurtenances required in the performance of all necessary operations for the complete construction and erection of the substructure for a drawbridge over the west arm of the south fork of the south branch of the Chicago river at South Ashland avenue, according to plans and specifications on file in the office of the Department of Public Works of said city, room 326 city hall.

Proposals must be made out upon blanks furnished at said office and be addressed to said department, indorsed "Proposals for Substructure, South Ashland Avenue Bridge," and be accompanied with three thousand dollars in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago and made payable to the order of the commissioner of public works.

The commissioner of public works reserves the right to reject any or all bids.

A deposit of five dollars will be required for the safe return of plans and specifications.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the commissioner of public works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

JOHN J. HANBERG,
6-2t Commissioner of Public Works.

Superstructure South Ashland Ave. Bridge, Department of Public Works.

Chicago, July 22, 1907.

Sealed proposals will be received by the city of Chicago until 11 a. m., Saturday, August 17, 1907, at room 224 City Hall, for the furnishing, delivering and building in place all temporary work and in furnishing all materials, tools, labor and all appliances and appurtenances required in the performance of all necessary operations for the complete construction and erection of the superstructure of a drawbridge over the west arm of the south fork of the south branch of the Chicago river at South Ashland avenue, according to plans and specifications on file in the office of the Department of Public Works of said city, room 326, City Hall.

Proposals must be made out upon blanks furnished at said office and be addressed to said department, indorsed "Proposals for Superstructure, South Ashland Ave. Bridge," and be accompanied with three thousand dollars in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago and made payable to the order of the commissioner of public works.

The commissioner of public works reserves the right to reject any or all bids.

A deposit of ten dollars will be required for the safe return of plans and specifications.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the commissioner of public works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

JOHN J. HANBERG,
6-2t Commissioner of Public Works.

STORM WATER SEWERS.

Omaha, Neb., July 29, 1907.

Sealed proposals will be received at the office of the City Engineer up to 2 o'clock p. m., Monday, August 26th, for the construction of storm water sewers and appurtenances as per plans and specifications on file in the office of the City Engineer.

The work to be done embraces approximately as follows:

840 feet sewer, 10 feet in diameter.

860 feet sewer, 11 feet 3 inches in diameter.

1,440 feet sewer, 12 feet in diameter.

250 feet, more or less, of 16 by 7½ reinforced concrete construction.

80 feet sewer 42 inches in diameter.

1,600 feet sewer, 30 inches in diameter.

150 feet open ditch work.

Payment for said work to be made upon a cash basis; 90 per cent on monthly estimates; an additional 5 per cent when work is accepted, and 5 per cent in one year after the completion of the work. Each bid shall be accompanied with a certified check in the sum of $3,000.00 as guarantee of good faith that the bidder will promptly enter into contract if award shall be made to him. The city reserves the right to reject any or all bids.

ANDREW ROSEWATER,
5-4t City Engineer.

INTERNAL IMPROVEMENT COMMISSION OF THE STATE OF ILLINOIS.

NOTICE TO BIDDERS.

Sealed proposals addressed to the "Internal Improvement Commission of the State of Illinois" and endorsed

"PROPOSAL FOR ALL OF THE WORK OF REINFORCING THE SHAWNEETOWN LEVEE"

will be received by the Engineer of the Commission at the office of the Mayor of Shawneetown, Ill., up to 12 o'clock noon (standard time) of Thursday, the 22d day of August, 1907, and thereafter the said bids will be opened by the Chairman of the said Commission and awarded to the lowest responsible bidder; or all bids may be rejected as he may decide best.

The work to be covered by said bids is borrowing, transporting and placing clay or other suitable material for levee building; all as set forth in the specifications under which the work will be done. The total amount of filling approximates fifty thousand cubic yards. Probably half of this amount can be most cheaply done by wagons; the other half is properly car work.

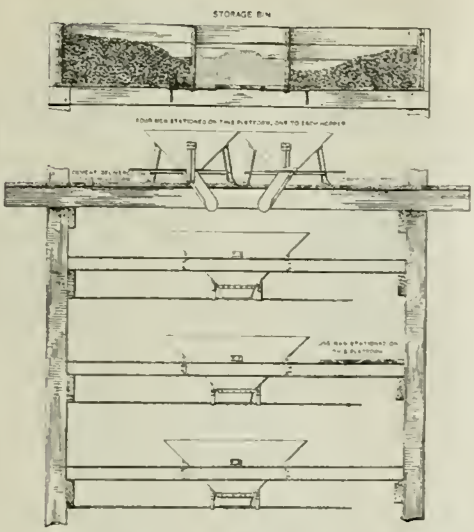
There is now available for this work sufficient railroad iron for any tracks needed.

Maps and specifications can be seen in the office of the Engineer in Shawneetown and in the office of the Chairman, 18th floor of the American Trust Building, Chicago. Bidders must before bidding personally examine the ground.

No bid will be accepted until the bidder has made proof satisfactory to the Chairman of his experience in such work and his ability to carry out the contract.

The Chairman reserves the right to reject any and all bids.

THE INTERNAL IMPROVEMENT COMMISSION OF ILLINOIS.
ISHAM RANDOLPH,
7-2t Chairman.



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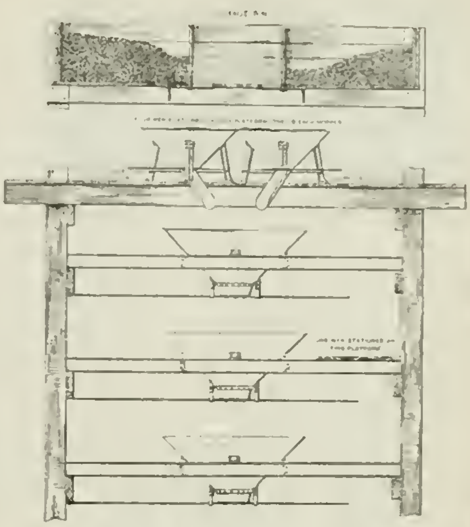

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WANTED—Collapsible forms for making concrete manholes. Address "Kan," care of Engineering-Contracting, 355 Dearborn St., Chicago.

CATALOGS—The technology department of Carnegie Library, Pittsburg, is making an extensive collection of trade catalogs. These will be carefully indexed under both firm name and subject, and will be accessible to the public. Mention this paper and address H. W. Carver, care of Technology Department.

WANTED—Required by leading German engineering works of world, wide reputation, an experienced engineer as representative with first-class connections in American railway financial circles, occupied in floating new companies and carrying out new lines; must be well up in all technical details and capable of managing also the commercial part. Send fully detailed proposals with references to F. F., 5586, care Rudolf Mosse, Berlin, S. W.

WANTED—Stone crusher and air compressor. Geo. J. Kirstein, Secy., Commercial Trust Bldg., Jersey City, N. J.

WANTED—Prices and other information regarding interlocking steel piling (not the channel and Z-bar kind), f. o. b. Woodstock, Vt. Address "C. E.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

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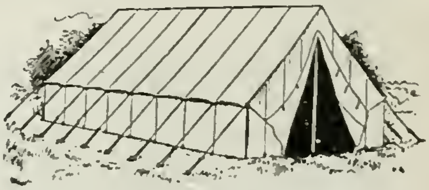

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Bucyrus 70 ton shovel (new)	9,900.00
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54x54x16 ft. stone planer	950.00
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12x12x14 Hall air compressor	650.00
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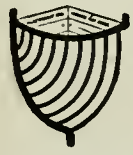

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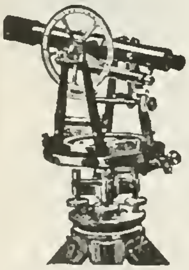

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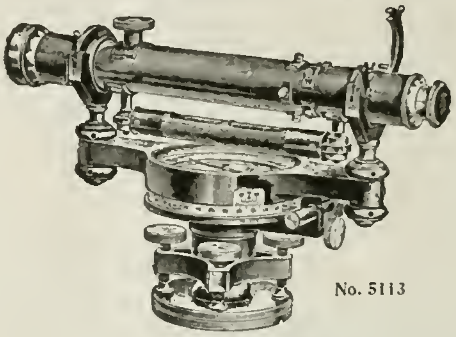

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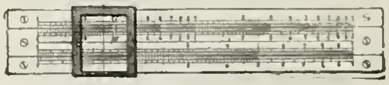

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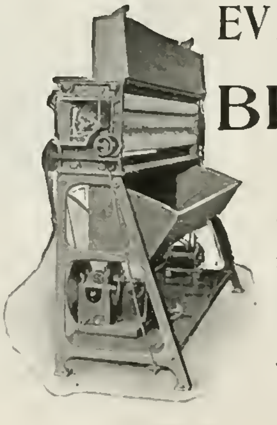

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Danie J. Hauer, Associate Editor Engineering Contracting.

The rapid growth of our paper has necessitated an increase in its editorial staff. In seeking a man for the position, we have had to consider two qualifications, first, his experience as an engineer or contractor, and, second, his ability as a writer. Mr. Daniel J. Hauer has qualified in every respect. He is a civil engineer, who has had many years' experience as contractor, and he is a writer well known for his excellent contributions to Engineering-Contracting, Engineering News, The Dirt Mover and other journals.

Nineteen years ago Mr. Hauer began his professional career as an axman on a southern railway. Since then his experience has covered a great variety of work, such as maintenance of way, construction of railroads, wagon roads, race tracks, parks, reservoirs, subways, sewers, irrigation, electric roads, etc. As an engineer his positions have ranged from axman to chief engineer. As a contractor, he has had years of experience in the business for himself, as well as in the employ of such firms as Wm. J. Oliver & Co.

Experience, as we have had occasion to say editorially, is often a great fetich. Breadth of experience means nothing unless it comes to a man who is constantly observing and analyzing. Those of our readers who have studied Mr. Hauer's articles on the methods and cost of doing different classes of work must have regretted the fact that he did not write more frequently and at greater length. Mr. Hauer's mind is of that type that finds new facts in the oldest of thingss. There is little of novelty in digging dirt. At least it would strike the casual observer so; but the cost analysis engineer looks at it with different eyes. He knows that the last word will never be said on the art of economic earth moving. To him the most ordinary sort of work is attractive because he feels that it may prove extraordinary in the profit it will yield if properly handled. By such a man each new piece of work is approached with pleasure because it offers a new problem in the economics of excavation. To him every experience, no matter when, nor where, nor how, is an experience of value. And such a man we believe Mr. Hauer to be. He joins our editorial staff, himself possessed of a great fund of cost data that have never before appeared in print, and Engineering-Contracting extends to him a most hearty greeting, not only in behalf of its editors, but in behalf of its readers.

Our Special Southern and Pacific Coast Number.

Beginning with the first issue in September, we shall publish what we have decided to call our Special Southern and Pacific Coast Number. ENGINEERING-CONTRACTING believes it now has a larger number of subscribers in the South and far West than any other civil engineering or contracting periodical. At any rate it will be only a short time until our circulation in those sections greatly exceeds that of any other technical paper. And, with a view to bringing this about, we intend to devote considerable space in the first issue of our paper each month to the South and Pacific coast. Not only shall we print articles of particular interest to subscribers in those sections, but several thousand sample copies of ENGINEERING-CONTRACTING will be mailed to contractors and civil engineers located there.

Our readers have always aided us materially by sending us the names of their friends to whom we could mail sample copies, and we trust that those dwelling in the South and on the "Coast" will be even more considerate than before in this respect. We also wish to add that contributed articles from the South and West will be particularly acceptable.

While there are few articles that we publish which do not interest engineers and contractors throughout the country, still it must be remembered that there are local conditions which make articles of a certain class especially valuable to men in certain sections. Thus, our recent articles on the cost of Howe truss bridges must necessarily be of most interest to those of our readers who reside in those parts of the far West and South where timber trusses are still built.

On the other hand, methods of construction that have been developed in one section can often be adopted with profit elsewhere. This is well illustrated by the hydraulic method of building dams and other embankments, a method invented in California and still used to a very limited extent east of the Rocky Mountains, but destined to find an ever increasing field of usefulness throughout the country.

Published in Chicago, ENGINEERING-CONTRACTING now reaches the extreme West and extreme South within 72 hours after publication, and we expect to see the time within a very few years when mail will take less than 48 hours to travel from Chicago to the western coast. Indeed, when trains make an average speed of a trifle more than 50 miles an hour, the trip will be made in 40 hours. It will require but a moderate increase in the present density of traffic to warrant double tracking all the main transcontinental lines; and, when that is done, the 40-hour train will be perfectly feasible, and the 48-hour train will surely become a reality. In the meantime ENGINEERING-CONTRACTING will identify itself with the interests of the South and West, both by strengthening its news service in those sections and by securing articles of special interest to contractors and engineers in those sections.

The Itemized Cost of Nine Barbed Wire Fences.

While more or less has found its way into print on the cost of barbed wire fences such as railways use along their rights of way, no very comprehensive presentation of fence data has ever been attempted. In this and in subsequent issues we shall give some very complete records covering a great number of different jobs. In all cases the work was done by railway section gangs, and in nearly every case a contractor could have done the work at less cost.

The standard right of way fence usually consists of four lines of barbed wire strung on cedar posts set 20 ft. apart. The prac-

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tice in spacing posts is variable, sometimes being 15 ft. centers, sometimes 24 ft. Farmers usually space fence posts a rod apart (16½ ft.). When the posts are spaced 20 ft. apart it is customary to support the wires between the posts by means of two wooden slats or wire stays, each 4 ft. long, and spaced about 7 ft. apart. These slats or stays prevent animals from spreading the fence wires apart in their efforts to get between them.

Bill of Material. The standard fence used on the O. R. & N. has posts 7 ft. long, 20 ft. c. to c., and bedded 28 ins. in the ground. The first wire is 13 ins. above the ground and the rest are 13 ins. apart, except the space between the upper two, which is 14 ins. The mill of materials is as follows per mile of fence:

265 posts, 7x7 in. x7 ft., split cedar.
530 slats, 1x3 in. x4 ft., fir.
21,120 lin. ft., or 1,410 lbs., two point galvanized cattle wire.
16 lbs. staples, 1½-in., No. 9 polished.
26 lbs. staples, 1¼-in., No. 9.

The following is a bill of materials and their estimated cost (not including labor) for the standard "second class fence" on the N. P., per mile:

1,340 lbs. (21,120 lin. ft.) galv. barb wire at 2¼ cts.	$30.15
280 lbs. No. 7 galv. wire stays (675 stays, 4 ft. long) at 2.8 cts.	7.84
16 lbs. 2-in. galv. wire staples (950 staples) at 2.35 cts.	0.38
2,800 galv. anchor fence clamps at 80 cts. per M	2.24
10 diagonal braces, 4x4 in. x12 ft., 160 ft. B. M., at $15	2.40
225 cedar posts (6-in.), 7 ft. long, at 10 cts.	22.50
6 lbs. 60d nails at 2.25 cts.	0.14
1 Eureka tubular gate, $4	4.00
Total materials	$69.65

For the last ten years the contract price for the labor of building such fences as this has not varied much from $75 a mile in the far West.

We shall now give the actual cost of a number of jobs of fence work on a western railway, showing the range of costs:

Cost of a Seven-Mile Fence. This fence was 7 miles long, built on ground that was rather rocky, making the cost of digging post holes quite high. The cost of the fence was as follows per mile:

Materials:	
1,300 lbs. barb wire at 2.65 cts.	$34.45
400 lbs. fence stays (100) at 2.75 cts.	11.00
90 lbs. fence clamps (3,900) at 6 cts.	5.40
16 staples (1,300) at 2.70 cts.	.43
352 posts (15 ft. c. to. c.) at 11 cts.	38.72
12 lbs. 40d nails at 2.25 cts.	.27
Total	$90.27
Labor:	
Loading and moving:	
3 hrs. foreman at 25 cts.	$ .75
16 hrs. laborers at 15 cts.	2.40
Total	$3.15
Removing brush:	
1 hr. foreman at 25 cts.	$ .25
30 hrs. laborers at 15 cts.	4.50
Total	$4.75
Distributing fence material:	
3 hrs. foreman at 25 cts.	$ .75
10 hrs. laborer at 15 cts.	1.50
Total	$2.25
Building fence:	
38 hrs. foreman at 25 cts.	$ 9.50
240 hrs. laborer at 15 cts.	36.00
Total	$45.50
Grand total labor	$55.65
Cost of labor and materials	$145.92

It will be noted that the cost of moving the gang of men once on this job was $3.15 per mile of fence, or $22 for this one move, in lost time of men. Such losses as this should not be forgotten, especially in estimating the cost of small jobs.

Cost of a 2,000-ft. Fence. This was a short fence with posts 16 ft. apart, 4 wires to the post. The exact length of the fence was 1,932 ft., or 120 panels of 16 ft., exclusive of 2 gates. There were 4 posts used for the gates and 8 posts used for braces. The cost of this 1,932-ft. fence was as follows:

Material:	
129 cedar posts, 7 ft.. at 7 cts.	$ 9.03
7,755 ft. barbed wire, 426 lbs., at 2 cts.	8.52
500 fence staples, 6 2/3 lbs., at 1.75 cts.	.11
360 stays (4 ft.), 122 lbs., at 3.15 cts.	3.86
1,440 fence clamps, 36.6 lbs., at 5.25 cts.	1.89
Freight on posts	2.00
Total for 1,932 ft.	$25.41
Two gates:	
4 cedar posts (7 ft.), at 7 cts.	$ .28
12 pcs. 1x6-in. x18-ft.=96 ft. B. M., at $15	1.44
4 lbs. 10d nails at 2.82	.11
Total for 2 gates	$1.83
Labor:	
2.6 days foreman at $2.50	$ 6.50
7.8 days laborers at $1.50	11.70
Total labor	$18.20

Excluding the gates, the cost of the materials was $69.40 per mile, and the cost of the labor was $49.70 per mile, or a total of $119.10 per mile.

Cost of a 9000-ft. Fence. This fence was of the same design as the one just described, the actual length being 8,974 ft.

The materials cost:

2,154 lbs. barb wire @ 2.76 ct.	$ 59.45
649 lbs. fence stays @ 2.75 ct.	17.85
149 lbs. fence clamps @ 5.95 ct.	8.87
26 lbs. fence staples @ 2.70 ct.	.70
577 posts @ 11 ct.	63.47
15 lbs. 40d nails @ 2.25 ct.	.34
1 lb. 10d nails @ 2.30 ct.	.02
2 lbs. 5d nails @ 2.55 ct.	.05
24 pcs. 1″x6′-16′ 192′ @ $8.50	1.63
Total cost of material	$152.38

This makes a cost of $89.63 per mile of fence, including farm gates, there being 4 such gates in the 9,000 ft. An additional cost was 32 posts used for anchoring and for braces, the 15 lbs. of 40d were also used on the anchors and braces. All the fence material had to be hauled from one to two miles on push cars by the crew to distribute it, and some brush had to be cleared away to build the fence. This and the other labor costs were:

Distributing material for fence:	
Foreman 7 da. @ $65	$ 1.52
Laborers 9 da. @ $1.50	13.50
Clearing brush to build fence.	
Laborer 1 da. @ $1.50	1.50
Building new fence:	
Foreman 3.3 da. @ $65	7.15
Laborers 37.3 da. @ $1.50	15.95
Putting up farm gate:	
Laborers 2 da. @ $1.50	3.00
Total labor	$82.62

A cost per mile of $48.60, making a total cost for materials and labor of $138.23.

Cost of a 2,640-ft. Fence. This fence was of the same design as those previously given, posts 16 ft. apart, with 4 wires. The fence was exactly half a mile long, but the costs have been reduced to the cost per mile for convenience of comparison.

Materials:	Per Mile.
21,360 ft. barb wire, 1,282 lbs., at 2.65 ct.	$33.98
978 fence stays, 394 lbs., at 2.75 ct.	10.84
3,912 fence clamps, 98 lbs., at 5.95 ct.	5.82
1,304 fence staples, 18 lbs., at 2.70 ct.	.48
330 fence posts at 11 ct.	36.30
Total materials per mile	$87.42
Labor:	
Distributing fence material:	
4 days labor at $1.50	$ 6.00
Erecting fence:	
2 days foreman at $2.50	5.00
20 days labor at $1.50	30.00
Total labor per mile	$41.00
Total material and labor	$128.42

Labor Costs on Four Different Fences. Having given the costs of materials and labor on several fences, we shall now omit the material item and give only the labor costs on fences, all of which had posts spaced 16 ft. apart, and 4 wires to the post. The first of these was 2,200 ft. long and the labor of erecting it cost at the following rate per mile:

	Per Mile.
Hauling out fence material:	
1.2 days foreman at $2.50	$ 3.00
12 days laborer $1.50	18.00
Total	$21.00
Building fence:	
1.4 days foreman at $2.50	3.50
16.8 days laborer at $1.50	25.20
Total	$28.70
Grand total	$49.70

This did not include $9 of lost time moving the gang from another job to this one.

The next job was the building of a fence 2,600 ft. long. The ground was rocky, making it necessary to anchor most of the posts. The labor cost at the following rate per mile:

	Per Mile.
Clearing brush:	
2 days labor at $2	$ 4.00
Building fence:	
2 days foreman at $3	6.00
34 days laborer at $2	68.00
Total	$78.00

In addition it cost $18 for the lost time of moving the men from another job to this one. Two farm gates were erected, and the cost of each was:

1 farm gate	$0.90
2 posts for gate at 10 ct.	0.20
Labor placing gate	2.00
Total	$3.10

The next job was a fence 2,300 ft. long. The labor cost at the following rate per mile:

	Per Mile.
Distributing fence material:	
1.1 day foreman at $3	$ 3.30
13.8 days laborer at $1.50	20.70
Total	$24.00
Clearing brush:	
2.4 days laborer at $1.50	$ 3.60
Building fence:	
1.1 day foreman at $3	3.30
21.8 days laborer at $1.50	32.70
Total	$36.00
Grand total labor	$63.60

In addition to this, the lost time moving to this job amounts to $10.

The next job was a fence 5,700 ft. long, and the labor cost at the following rate per mile:

	Per Mile.
Distributing fence material:	
3.8 days laborer at $1.50	$ 5.70
Building fence:	
1.8 days foreman at $3	5.40
16.6 days laborer at $1.50	24.90
Loading barb wire on car:	
0.5 day foreman at $2.50	1.25
2.5 day laborer at $1.25	3.13
Grand total labor	$40.38

Fence 5,000 Ft. Long. The posts in this example were 20 ft. center to center. One gate was built. The material cost:

254 fence posts 4.5 ct	$11.43
1,215 lbs. No. 9 galv. iron wire, 2 ct	24.30
285 lbs. fence stays, 3.75	10.65
96 lbs. fence clamps, 6.25 ct	6.00
13 lbs. fence staples, 2.20 ct	.29
1 lb. 40d nails, 1.5 ct	.02
3 pcs. 2"x6"-16' 48', $11.50	.55
	$53.24

Labor cost as follows:

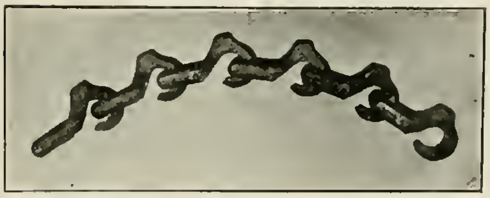
Foreman 6 da. @ $48.75	$ 9.67
Laborers 18 da. @ $1.50	27.00
	$36.67

Making a cost per mile for material of $55.96, for labor $38.52, and a total cost $94.48. This includes one gate.

Some experiments were made recently in Massachusetts in destroying gipsy and browntail moths by attracting them to sticky fly paper by means of lights. In one case two large wire frames were set up and covered with sheets of sticky fly paper, the trap being suspended in the glare of arc lights for two weeks. In that time it was found that 2,104 months had been caught. In another case boards covered with fly paper were placed around trees within range of powerful lights. In these 32 traps a total of 1,630 moths were caught. Judging from the results of the experiments it is not probable that the arc light plan will be adopted for exterminating the pests, for it was found that subsoil and the roots of the trees. Then, of the moths caught, 94.8 per cent were males and 5.2 per cent were females.

The Clauser Link Chain Belt.

In describing the concrete material conveying plant used in the construction of the large reinforced concrete warehouse for Montgomery Ward & Co., of Chicago., Ill., described in our issue of May 29, 1907, mention was made of a chain belt drive in which the chain was operated as a cross belt on 8-ft. centers. The accompanying cut shows the type of chain used for this drive. It is known as the Clauser chain and is made by the Link Chain Belt Co., of New York city. The distinctive feature of this chain belt is that the teeth are situated on the chain and not on the sprocket wheel. The sprocket wheel has on its face two flanges between which the traveling chain is guided and between the flanges a series of depressions or sockets in which the teeth or knuckles of the chain gear. As will be seen the links of the chain are not connected by pins or rivets but are so coupled together that one or any number of links can be taken out or added. This feature enables the chain to be operated as a cross belt by the simple expedient of reversing alternate links. When this is done, as will be readily seen, the knuckle of one link projects upward, that of the next link projects downward, and so on, and the chain readily gears with two sprockets rotating in opposite directions. Other claims made for this chain are, that its teeth are so designed that rolling contact exists between the chain and the sprockets and that the links, not having to be slotted to receive the sprocket wheel teeth, are stronger for the same weight of metal.



The Clauser Link Chain Belt.

The Cost of Three Short Single Track Tunnels.

Short tunnels are usually constructed at less cost than long tunnels, not only because of the less cost of hauling the "muck" and the ease of ventilating the tunnel, but because a very inexpensive plant can be used. In limestone and sandstone formations the present contract prices average about $45 per lin. ft. of single track tunnel for all lengths up to 1,000 ft. or so, even where common laborers receive $2.25 a day. The following data give the actual cost of three tunnels built by contract in the West, and, both as to prices and as to quantities, these examples will be useful to engineers and contractors:

Tunnel No. 1.
(900 lin. ft.)

	Per Lin Ft.
Excavating tunnel	$45.00
2.7 cu. yds. enlargement for lining at $3.00	8.10
350 ft. B. M. timber lining at $20	7.00
5.7 lbs. iron at $0.03	0.17
Total	$60.27

Tunnel No. 2.
(600 lin. ft.)

	Per Lin. Ft.
Excavating tunnel	$45.00
2.7 cu. yds. enlargement at $3.00	8.10
370 ft. B. M. lining at $20.00	7.40
5.5 lbs. iron at $0.03	0.17
Total	$60.67

Tunnel No. 3.
(400 lin. ft.)

	Per Lin. Ft.
Excavating tunnel	$42.50
2.8 cu. yds. enlargement at $3.00	8.40
400 ft. B. M. lining at $20.00	8.00
7.4 lbs. iron at $0.03	0.22
Total	$59.12

In addition to the above costs which are based on the contractor's final estimate, there was a cost $3 per lin. ft. (or about 5%) for engineering and superintendence, and a cost of $0.50 per lin. ft. for train service.

The Chicago & Northwestern R. R. has awarded a contract for the construction of a double-tracked steel bridge two miles long across the Mississippi River at Clinton, Iowa. The bridge will cost $2,000,000 and is to be completed by Feb. 1, 1910. It will be built south of and adjoining the present single track steel bridge, which will be removed when the new bridge is completed.

It is expected that the Royal Edward dock at Avonmouth, on the Bristol Channel, England, now under construction, will be completed by the end of the year. The dock will be entered from the Bristol Channel through a lock 875 ft. long and 100 ft. wide, with a depth of 36 ft. of water in the outer sill at ordinary neap tides and 46 ft. at spring tides. At the outer end of the lock will be two piers, with a lighthouse at the end of each. There will also be a dry dock 850 ft. in length. The lighthouse on the south pier will have a green occulting light and will carry a powerful fog bell. On the north pier will be a white flashing light from the summit and from a lower level a subsidiary red light. On one side of the dock will be two transit sheds, each 500 ft. long and two stories high, and on the other 450 ft. of sheds. A granary is under construction with a capacity of 500,000 bushels. Cranes, conveyor belts, and appliances for automatic weighing will be in place, and grain-conveying and elevating machinery will be worked by electric current. The dock will be completely surrounded by lines of rails connected with the Great Western and Midland Railroad companies.

Cost of Trenching, Pipelaying and Backfilling for Pipe Sewer Construction at Centerville, Ia.

In constructing some 12,366 ft. of 8 to 12 in. pipe sewer at Centerville, Ia., careful records of cost were kept by Mr. M. G. Hall, Centerville, Iowa, engineer in charge. From these records kindly furnished by Mr. Hall we have compiled the accompanying tables. The work comprised 30 separate jobs or sections of sewer construction and the tables give the total man hours and the total cost per lineal foot of sewer for each class of labor for each of 30 jobs. They also give a summary of the labor and other costs of this work per lineal foot of sewer.

Mr. Hall describes the method of collecting the original data as follows:

"In the first place the account of the labor was kept by the inspector of the work and he had his instructions to be careful to account for all the men and where they worked. He was furnished with a blank and was required to turn these reports over to the engineer in charge each morning as he came on the work, of course turning in the report that covered the previous day's work. Together they would look over the report and make such corrections as might be necessary while the conditions were still fresh in mind. In this way what was considered to be an accurate account of the labor was obtained in a classified form so that by applying the wage per hour the daily cost could be readily obtained. However, no attempt was made to keep the actual cost for each day. It was kept rather by sections, as will be shown by the table to follow. Such other data as called for

	JOB I.		JOB II.		JOB III.		JOB IV.		JOB V.		JOB VI.	
Size of pipe, ins	8		8		8		8		8		8	
Length of pipe, ft	177		368		361		300		727		280	
Average depth of trench, ft	6.0		12.1		7.2		12.4		7.5		10.3	
Width of trench, ins	22		24		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds.	0.407		0.896		0.489		0.842		0.51		0.699	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Bottom men at 17 cts. per hour	60	$0.0872	600	$0.2772	282	$0.1328	600	$0.3400	600	$0.1403	320	$0.1943
Top men at 17 cts. per hour	9	0.0131	131	0.0605	22	0.0104	182	0.1031	142	0.0332	141	0.0856
Total labor trenching	69	0.1003	731	0.3377	304	0.1432	782	0.4431	742	0.1735	461	0.2799
PIPELAYING:—												
Pipelayer at 30 cts. per hour	5	0.0085	20	0.0163	12	0.0099	27	0.0270	45	0.0186	23	0.0246
Pipelayer's helpers at 15 cts. per hour	10	0.0085	39	0.0159	24	0.0100	54	0.0270	91	0.0188	42	0.0225
Total labor pipelaying	15	0.0170	59	0.0322	36	0.0199	81	0.0540	136	0.0374	65	0.0471
GENERAL SERVICE:—												
Foreman at 35 cts. per hour	10	0.0198	27	0.0257	9	0.0087	25	0.0292	50	0.0241	27	0.0338
Water boy at 10 cts. per hour	16	0.0090	27	0.0073	9	0.0025	27	0.0090	50	0.0069	27	0.0096
Total labor general service	26	0.0288	54	0.0330	18	0.0112	52	0.0382	100	0.0310	54	0.0434
BACKFILLING:—												
By hand at 16 cts. per hour	14	0.0127	82	0.0356	92	0.0408	85	0.0453	57	0.0125	42	0.0240
Team and two men at 52½ cts. per hour	2	0.0059	28	0.0400	...	......	14	0.0245	22	0.0158	17	0.0319
Total labor backfilling	16	0.0186	110	0.0756	92	0.0408	99	0.0698	79	0.0283	59	0.0559
Grand total labor	126	0.1306	954	0.4785	450	0.2151	1014	0.6051	1057	0.2702	639	0.4263
Labor cost per cu. yd. trenching	$0.2464		$0.3780		$0.2928		$0.5262		$0.3402		$0.4004	
Labor cost per cu. yd. backfilling	0.0457		0.0844		0.0834		0.0829		0.0555		0.0799	
SUMMARY OF COSTS:—												
Labor per lin. ft. of pipe	0.1306		0.4785		0.2151		0.6051		0.2702		0.4263	
Pipe per lin. ft.	0.1360		0.136		0.136		0.136		0.136		0.136	
Cement per lin. ft.	0.0050		0.005		0.005		0.005		0.005		0.005	
Total cost per lin. ft.	0.2716		0.6195		0.3561		0.7461		0.4112		0.5673	
Contract price per lin. ft.	0.5300		0.53		0.53		0.53		0.53		0.53	

	JOB VII.		JOB VIII.		JOB IX.		JOB X.		JOB XI.		JOB XII.	
Size of pipe, ins	12		10		10		10		8		10	
Length of pipe, ft	427		352		360		363		360		370	
Average depth of trench, ft	9.6		10.1		10.2		9.5		6.6		9.0	
Width of trench, ins	24		22		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds.	0.711		0.686		0.693		0.645		0.448		0.611	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Bottom men at 20 cts. per hour	462	$0.2164	322	$0.1830	422	$0.2344	222	$0.1223	153	$0.0850	418	$0.2260
Top men at 17½ cts. per hour	118	0.0484	130	0.0646	211	0.1026	145	0.0699	45	0.0219	222	0.1050
Total labor trenching	580	0.2648	452	0.2476	633	0.3370	367	0.1922	198	0.1069	640	0.3310
PIPELAYING:—												
Pipelayer at 30 cts. per hour	42	0.0295	23	0.0196	22	0.0183	34	0.0281	15	0.0125	34	0.0276
Pipelayer's helpers at 18 cts. per hour	80	0.0337	46	0.0235	44	0.0220	71	0.0352	20	0.01	42	0.0204
Total labor pipelaying	122	0.0632	69	0.0431	66	0.0403	105	0.0633	35	0.0225	76	0.0480
GENERAL SERVICE:—												
Foreman at 44.4 cts. per hour	42	0.0437	26	0.0328	26	0.0321	40	0.0489	9	0.0111	47	0.0564
Water boy at 8⅓ cts. per hour	46	0.0090	26	0.0062	26	0.0060	34	0.0078	9	0.0021	47	0.0106
Total labor general service	88	0.0527	52	0.0390	52	0.0381	74	0.0567	18	0.0132	94	0.0670
BACKFILLING:—												
By hand at 17½ cts. per hour	54	0.0221	42	0.0209	51	0.0248	70	0.0337	41	0.0199	17	0.0080
Team and two men at 59 cts. per hour	11	0.0152	21	0.0352	11	0.0180	10	0.0163	3	0.0049	8	0.0128
Total labor backfilling	65	0.0373	63	0.0561	62	0.0428	80	0.0500	44	0.0248	25	0.0208
Grand total labor	855	0.4180	636	0.3858	813	0.4582	626	0.3622	295	0.1674	835	0.4668
Labor cost per cu. yd. trenching	$0.3724		$0.3609		$0.4863		$0.2980		$0.2386		$0.5417	
Labor cost per cu. yd. backfilling	0.0525		0.0818		0.0618		0.0775		0.0554		0.0340	
SUMMARY OF COSTS:												
Labor per lin. ft. of pipe	0.4180		0.3858		0.4582		0.3622		0.1674		0.4668	
Pipe per lin. ft.	0.260		0.2000		0.20		0.20		0.136		0.20	
Cement per lin. ft.	0.007		0.0060		0.0060		0.006		0.005		0.006	
Total cost per lin. ft.	0.6850		0.5918		0.6642		0.5682		0.3084		0.6728	
Contract price per lin. ft.	0.64		0.64		0.64		0.64		0.53		0.64	

on the inspector's blanks were also obtained by the inspector each day. In but one or two instances did I have any trouble in getting accurate accounts from the inspectors, for, while it may seem strange to some, almost without exception the inspectors seemed to consider it a pleasure as well as a duty to take an interest in these reports. They received no compensation for this extra work. An important advantage in keeping the work by blocks or sections is evident, for in this way a good record could be kept of the kind of material excavated and its condition relative to easy or difficult moving. This part of the data was largely kept by myself and from my personal observation.

"Of course, there are always labor costs to the contractor which do not come under the observation of the inspector, and it is hard for anybody except the contractor to know what these costs are, and many times he could not separate these incidental costs, such as handling tools, unloading and hauling materials, moving materials from place to place in order to use up all odds and ends possible, and various other minor costs. Hence it is very possible that labor costs deduced from these figures should be increased by some percentage which I would estimate at 10 per cent for the average case."

Good progress was made in 1906 by the various railroad companies in track elevation work in Chicago, Ill. The amount of elevation work that has been completed from May 23, 1892, to Dec. 31, 1906, is as follows: Total number miles of main track elevated, 107.75; total number miles of all tracks elevated, 628; total number of subways constructed, 495; total estimated cost of work completed, $41,025,250.

The governments of the Transvaal and Orange River, South Africa, control the railways of both colonies under the name of the Central South African Railways. The mileage of the two colonies at the end of 1906 was about 2,500, or more than 100 per cent greater than in 1898. For the year ending June 30, 1906, there were 6,871,546 persons and 3,904,717 tons of goods hauled.

	JOB XIII.		JOB XIV.		JOB XV.		JOB XVI.		JOB VXII.		JOB XVIII	
Size of pipe, ins	8		8		8		8		10		8	
Length of pipe, ft	367		252		359		300		328		426	
Average depth of trench, ft	11.2		9.5		12.1		11.1		8.0		8.8	
Width of trench, ins	22		22		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds	0.876		0.645		0.822		0.754		0.543		0.598	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin ft.	Total hours.	Cost per lin. ft
Bottom men at 20 cts. per hour	487	$0.2654	240	$0.1905	462	$0.2574	448	$0.2987	191	$0.1165	321	$0.1507
Top men at 17½ cts. per hour	177	0.0844	103	0.0715	237	0.1155	128	0.0747	140	0.0747	162	0.0666
Total labor trenching	664	0.3498	343	0.2620	699	0.3729	576	0.3734	331	0.1912	483	0.2173
PIPELAYING:—												
Pipelayer at 30 cts. per hour	34	0.0278	20	0.0238	29	0.0242	29	0.0290	21	0.0192	20	0.0141
Pipelayer's helpers at 18 cts. per hour	68	0.0333	40	0.0286	58	0.0291	57	0.0342	38	0.0208	39	0.0165
Total labor pipelaying	102	0.0611	60	0.0524	87	0.0533	86	0.0632	59	0.0400	59	0.0306
GENERAL SERVICE:—												
Foreman at 44.4 cts. per hour	37	0.0447	19	0.0335	30	0.0371	30	0.0444	18	0.0244	24	0.0250
Water boy at 8½ cts. per hour	37	0.0084	19	0.0063	30	0.0070	30	0.0083	18	0.0046	24	0.0047
Total labor general service	74	0.0531	38	0.0398	60	0.0441	60	0.0527	36	0.0290	48	0.0297
BACKFILLING:—												
By hand at 17½ cts. per hour	61	0.0291	37	0.0257	77	0.0376	42	0.0245	....	...	51	0.0210
Team and two men at 59 cts. per hour	21	0.0338	16	0.0374	22	0.0361	33	0.0649	15	0.0270	24	0.0332
Total labor backfilling	82	0.0629	53	0.0631	99	0.0737	75	0.0894	15	0.0270	75	0.0542
Grand total labor	922	0.5269	494	0.4173	945	0.5440	797	0.5787	441	0.2872	665	0.3318
Labor cost per cu. yd. trenching	$0.3993		$0.4062		$0.4536		$0.4940		$0.3521		$0.3634	
Labor cost per cu. yd. backfilling	0.0718		0.0978		0.0897		0.1186		0.0497		0.0906	
SUMMARY OF COSTS:—												
Labor per lin. ft. of pipe	0.5269		0.4173		0.5440		0.5787		0.2872		0.3318	
Pipe per lin. ft.	0.136		0.136		0.136		0.136		0.200		0.136	
Cement per lin. ft	0.005		0.005		0.005		0.005		0.006		0.005	
Total cost per lin. ft	0.5679		0.5583		0.6850		0.7197		0.4932		0.4728	
Contract price per lin. ft	0.530		0.530		0.530		0.530		0.640		0.530	

	JOB XIX.		JOB XX.		JOB XXI.		JOB XXII.		JOB XXIII.		JOB XXIV.	
Size of pipe, ins	8		8		10		10		8		8	
Length of pipe, ft	243		388		406		377		426		612	
Average depth of trench, ft	8.7		10.4		12.6		8.8		6.9		11.8	
Width of trench, ins	22		22		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds	0.591		0.706		0.856		0.474		0.468		0.801	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin ft
Bottom men at 20 cts. per hour	190	$0.1564	399	$0.2057	459	$0.2261	330	$0.1751	263	$0.1235	769	$0.2513
Top men at 17½ cts. per hour	83	0.0598	144	0.0649	264	0.1138	120	0.0557	57	0.0234	341	0.0975
Total labor trenching	373	0.2162	543	0.2706	723	0.3399	450	0.2308	320	0.1469	1110	0.3488
PIPELAYING:—												
Pipelayer at 30 cts. per hour	19	0.0235	24	0.0185	46	0.0340	34	0.0271	19	0.0134	57	0.0279
Pipelayer's helpers at 18 cts. per hour	38	0.0281	48	0.0223	64	0.0284	66	0.0315	38	0.0160	102	0.0300
Total labor pipelaying	57	0.0516	72	0.0408	110	0.0624	100	0.0586	57	0.0294	159	0.0579
GENERAL SERVICE:—												
Foreman at 44.4 cts. per hour	8	0.0146	29	0.0332	48	0.0525	28	0.0330	16	0.0167	64	0.0464
Water boy at 8½ cts. per hour	8	0.0027	29	0.0062	48	0.0098	28	0.0062	16	0.0031	63	0.0086
Total labor general service	16	0.0173	58	0.0394	96	0.0623	56	0.0392	32	0.0198	127	0.0550
BACKFILLING:—												
By hand at 17½ cts. per hour	7	0.0050	44	0.0198	48	0.0207	186	0.0863	15	0.0062	122	0.0349
Team and two men at 59 cts. per hour	8	0.0194	25	0.0380	22	0.0320	9	0.0141	13	0.0180	31	0.0299
Total labor backfilling	15	0.0244	69	0.0578	70	0.0527	195	0.1004	28	0.0242	153	0.0648
Grand total labor	461	0.3095	742	0.4086	999	0.5173	801	0.4290	437	0.2203	1549	0.5265
Labor cost per cu. yd. trenching	$0.3658		$0.3833		$0.3971		$0.4848		$0.3139		$0.4355	
Labor cost per cu. yd. backfilling	0.0413		0.0819		0.0616		0.2119		0.0517		0.0809	
SUMMARY OF COSTS:—												
Labor per lin. ft. of pipe	0.3095		0.4086		0.5173		0.4290		0.2203		0.5265	
Pipe per lin. ft.	0.136		0.136		0.20		0.20		0.136		0.136	
Cement per lin. ft	0.005		0.005		0.006		0.006		0.005		0.005	
Total cost per lin. ft	0.4505		0.5496		0.7233		0.635		0.3613		0.6675	
Contract price per lin. ft	0.530		0.530		0.640		0.640		0.530		0.530	

	JOB XXV.		JOB XXVI		JOB XXVII.		JOB XXVIII		JOB XXIX		JOB XXX.	
Size of pipe, ins	8		8		8		8		8		8	
Length of pipe, ft	285		695		610		200		237		537	
Average depth of trench, ft	8 6		9 6		11 6		9 8		13 5		5 8	
Width of trench, ins	22		22		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds.	0 584		0.652		0 788		0.665		0.916		0.394	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin ft.	Total hours.	Cost per lin. ft.	Total hours	Cost per lin. ft.
Bottom men at 20 cts. per hour	207	$0 1453	576	$0 1658	621	$0 2037	197	$0 1970	422	$0 3561	249	$0 0927
Top men at 17½ cts. per hour	69	0 0388	365	0.0919	372	0 1067	78	0.0682	185	0.1366	103	0 0336
Total labor trenching	276	0.1841	941	0.2577	993	0.3104	275	0.2652	607	0 4927	352	0 1263
PIPELAYING:—												
Pipelayer at 30 cts. per hour	15	0 0158	47	0.0203	52	0.0256	13	0 0195	21	0 0266	18	0 0100
Pipelayer's helpers at 18 cts. per hour	30	0.0190	94	0 0243	96	0.0283	22	0.0198	34	0 0258	36	0 0121
Total labor pipelaying	45	0.0348	141	0.0446	148	0.0539	35	0 0393	55	0 0524	54	0 0221
GENERAL SERVICE:—												
Foreman at 44.4 cts. per hour	11	0.0171	59	0.0377	62	0 0451	13	0 0289	42	0 0787	19	0.0157
Water boy at 8⅓ cts. per hour	13	0.0038	56	0.0067	53	0.0072	15	0 0062	42	0.0148	19	0.0029
Total labor general service	24	0.0209	115	0.0444	115	0.0523	28	0 0351	84	0 0935	38	0 0186
BACKFILLING:—												
By hand at 17½ cts. per hour	12	0 0074	18	0.0045	96	0.0275	2	0.0017	115	0 0849	10	0.0033
Team and two men at 59 cts. per hour	12	0.0248	36	0.0306	37	0.0358	9	0.0266	5	0 0125	22	0.0241
Total labor backfilling	24	0 0322	54	0.0351	133	0 0633	11	0.0283	120	0 0974	32	0 0274
Grand total labor	360	0 2720	1251	0.3818	1389	0.4799	349	0.3679	866	0.7360	476	0.1944
Labor cost per cu. yd. trenching	$0 3152		$0.3953		$0.3939		$0.3988		$0.5379		$0.3206	
Labor cost per cu. yd. backfilling	0.0551		0.0539		0.0803		0.0426		0.1063		0.0695	
SUMMARY OF COSTS:—												
Labor per lin. ft. of pipe	0.2720		0.3818		0.4799		0.3679		0.7360		0.1944	
Pipe per lin. ft.	0.136		0.136		0.136		0.136		0.136		0.136	
Cement per lin. ft	0.005		0.005		0.005		0.005		0.005		0.005	
Total cost per lin. ft	0.4130		0.5228		0.6209		0.5089		0 8770		0.3354	
Contract price per lin. ft	0.53		0.53		0.53		0.53		0.53		0.53	

	JOB XXXI.		JOB XXXII.		JOB XXXIII.		JOB XXXIV.		JOB XXXV.		JOB XXXVI.	
Size of pipe, ins	12		12		12		12		12		12	
Length of pipe, ft	171		316		208		234		371		246	
Average depth of trench, ft	7.6		12.2		13 1		11.0		8.1		8.3	
Width of trench, ins	24		24		24		24		24		24	
Excavation per lin. ft. of trench, cu. yds.	0.563		0.904		0.97		0.815		0.6		0.615	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Bottom men at 20 cts. per hour	277	$0.3240	1229	$0.7778	570	$0.5481	490	$0.4188	525	$0.2830	379	$0.3081
Top men at 17½ cts. per hour	....	.....	....	.....	145	0.1220	110	0.0823	76	0.0358	57	0 0405
Total labor trenching	277	0 3240	1229	0.7778	715	0.6701	600	0.5011	601	0.3188	436	0.3486
PIPELAYING:—												
Pipelayer at 30 cts. per hour	20	0.0351	80	0.0759	42	0.0606	38	0.0487	32	0.0259	27	0.0329
Pipelayer's helpers at 20 cts. per hour	38	0.0444	85	0.0538	40	0.0384	45	0.0385	52	0.0281	53	0.0431
Total labor pipelaying	58	0 0795	165	0.1297	82	0.0990	83	0.0872	84	0.0540	80	0.0760
GENERAL SERVICE:—												
Foreman at 35 cts. per hour	45	0.0921	71	0.0786	60	0.1010	35	0.0523	45	0 0424	26	0 0370
Water boy	....	......	....	......	....	.....	....	......	....	....	...	...
Total labor general service	45	0.0921	71	0.0786	60	0.1010	35	0.0523	45	0.0424	26	0.0370
BACKFILLING:—												
By hand at 17½ cts. per hour	72	0.0737	143	0.0792	130	0 1093	69	0.0516	26	0.0123	72	0.0512
Team and two men at 52½ cts. per hour	....	.....	....	......	....	.....	5	0.0112	22	0.0311	15	0.0320
Total labor backfilling	72	0.0737	143	0.0792	130	0.1093	74	0.0628	48	0.0434	87	0.0832
Grand total labor	452	0.5693	1608	1.0653	987	0 9794	792	0 7034	778	0.4586	629	0.5448
Labor cost per cu. yd. trenching	$0.5755		$0.8640		$0.6908		$0.6148		$0.5313		$0.5672	
Labor cost per cu. yd. backfilling	0 1309		0.0876		0.1127		0.0771		0.0723		0.1353	
SUMMARY OF COSTS:—												
Labor per lin. ft. of pipe	0.5693		1.0653		0.9794		0.7034		0.4586		0.5448	
Pipe per lin. ft.	0.260		0.260		0.260		0.260		0.260		0 260	
Cement per lin. ft	0.007		0.007		0.007		0.007		0.007		0 007	
Total cost per lin. ft	0.8363		1.3323		1.2464		0.9704		0.7256		0.8118	
Contract price per lin. ft	0.64		0.64		0.64		0 64		0.64		0 64	

Enlargement of the Kiel canal between the Baltic Sea and the North Sea is projected. The bottom width is to be increased from 72 ft. to 144 ft. (22 m. to 44 m.) and the depth from 29½ ft. (9 m.) to 36 ft. (11 m.). The enlargement prism is on one side of the existing channel, with substantially the same arrangement of side slopes (1 to 3 at the bottom, changing in several gradations to 1 to 1½ at the top) except that an 8-ft. berm 6½ ft. below mean water level is omitted. The width at mean water is increased from 220 ft. (67 m.) to 333 ft. (101.75 m.). Two new tidal locks are needed at either end, of dimensions 1,083 ft. long, 148 ft. wide, 45 ft. deep, (330 m. by 45 m. by 13.77 m.). Eleven passing points in the enlarge canal will replace eight present ones. Two swing-bridges are to be replaced by high-level bridges. The whole work is estimated to cost about $55,000,000. The enlargement is made necessary by the great increase of traffic through the canal.

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(1) Soft easy spading. (2) Dry hard clay. Very hard spading and pick work. (3) 100′ hard spading. Rest soft easy spading. (4) Very dry and hard pick and spade work. (5) Very dry and hard pick and spade work. (6) Very dry and hard spading joint clay. (7) 200′ hard yellow mottled clay, 227′ soft loam, 25′ culvert, all wet ditch in bottom. (8) Yellow sand clay bottom, easy spading, 100′ dry hard gumbo. (9) Yellow sandy clay bottom, easy spading, 100′ dry hard gumbo, 3 railway tracks in 13′ cut tunneled (10) Two railway tracks in 14′ cut, wet bottom, easy spading. (11) Soft easy spading. (12) 150′ hard clay. Strata of water bearing sand near top. Rest hard joint clay. (13) Hard dry clay, mostly joint clay. (14) Hard dry clay, mostly joint clay. (15) Hard dry clay, mostly joint clay. (16) Hard dry clay, mostly joint clay. (17) Easy spading, 10′ wet bottom. (18) Easy spading dry joint clay. (19) 1-6′ tunnel, 100′ had 6′ made dirt, rest easy spading. (20) Good spading, gumbo and joint clay. (21) Three railway tracks, three tunnels 9′ long, gumbo. (22) 2-10′ tunnel under street car tracks, easy spading, alongside of railway embankment. (23) Easy spading in gumbo. (24) Hard spading in joint clay, slipping banks. (25) Joint clay, dry and hard. (26) Gumbo, dry and hard. (27) Joint clay and gumbo, dry and hard. (28) Joint clay and gumbo, dry and hard. (29) Joint clay, 3-30′ tunnels under C. R. I. & P. tracks. (30) Gumbo, easy spading. (31) Easy spading, rock in ditch. (32) Very hard shale and rock. Pick work and blasting. (33) Very hard shale and rock. Pick work and blasting. (34) Moderate spading. (35) Easy spading. (36) Easy spading. (37) Easy spading. (38) Easy spading. (39) Easy spading. wet.

	JOB XXXVII.		JOB XXXVIII.		JOB XXXIX.	
Size of pipe, ins.	12		12		12	
Length of pipe, ft.	406		421		338	
Average depth of trench, ft.	12.3		8.9		7.6	
Width of trench, ins.	24		24		24	
Excavation per lin. ft. of trench, cu. yds.	0.911		0.66		0.563	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Bottom men at 20 cts. per hour	630	$0.3104	559	$0.2656	388	$0.2296
Top men at 17½ cts. per hour	279	0.1203	78	0.0324	63	0.0326
Total labor trenching	909	0.4307	637	0.2980	451	0.2622
PIPELAYING:—						
Pipelayer at 30 cts. per hour	54	0.0399	30	0.0214	17	0.0151
Pipelayer's helpers at 20 cts. per hour	109	0.0537	59	0.0280	34	0.0201
Total labor pipelaying	163	0.0936	89	0.0494	51	0.0352
GENERAL SERVICE:—						
Foreman at 35 cts. per hour	49	0.0422	30	0.0249	17	0.0176
Water boy	....	....	...	..	...	.. ..
Total labor general service	49	0.0422	30	0.0249	17	0.0176
BACKFILLING:—						
By hand at 17½ cts. per hour	26	0.0112	73	0.0303	85	0.0440
Team and two men at 52½ cts. per hour	13	0.0168	19	0.0237	4	0.0062
Total labor backfilling	39	0.0280	92	0.0540	89	0.0502
Grand total labor	1160	0.5945	848	0.4263	608	0.3652
Labor cost per cu. yd. trenching	$0.4728		$0.4515		$0.4657	
Labor cost per cu. yd. backfilling	0.0307		0.0818		0.0891	
SUMMARY OF COSTS:—						
Labor per lin. ft. of pipe	0.5945		0.4263		0.3652	
Pipe per lin. ft.	0.260		0.260		0.260	
Cement per lin. ft.	0.007		0.007		0.007	
Total cost per lin. ft.	0.8615		0.6933		0.6322	
Contract price per lin. ft.	0.64		0.64		0.64	

Methods of Quarrying Granite in Aberdeenshire, Scotland.*

BY WILLIAM SIMPSON.

The account of British practice in granite quarrying given in this paper, presents several points that are of general or special interest to American quarry operators.

(1) The frame on which the drills are mounted for breast hole work (Fig. 5) are particularly simple devices and should be applicable to many conditions of American work.

(2) It is of commercial as well as of engineering interest to note that American rock drills are chiefly used in these British quarries.

(3) The speed of drilling appears to be very slow. A depth of hole of 21 ft. per day is about half the speed attained in American granite quarrying. It is evident that the Aberdeenshire rock is very hard since a new bit is required for every foot of depth of hole, but this would hardly account for the very slow speed. One is disposed to believe that the machines must be rather inefficiently operated.

(4) The spacing of the horizontal holes only 4½ ins. c. to c. in groups of three to seven holes is a feature worthy of note.

(5) The use of a steam jet to work out the tamping of an unfinished hole is interesting. It is to be observed that the tamping used is granite chips; with loam tamping the jet would seem to be less efficient.

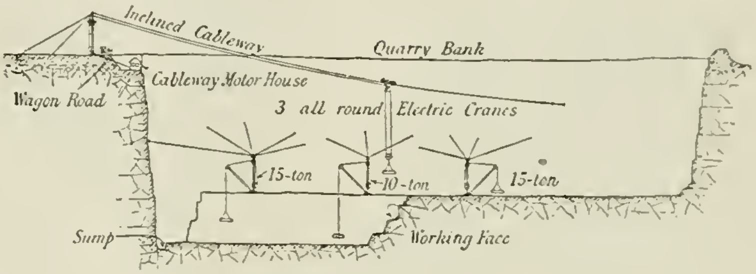

Fig. 1.—Section of Rubislaw Quarry.

(6) It is interesting to observe that the author considers that the successful working of such a quarry as those described would be almost impossible without cableways.

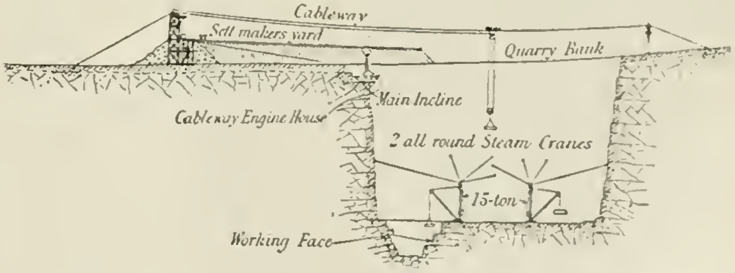

Fig. 2.—Section of Kemnay Quarry.

(7) A novel feature of the cableways used and so far as we know, a unique feature is the use of an endless rope (Fig. 7) for operating the carriage.

(8) It is also of interest to note the method (Fig. 8) of preventing overloading of cableway by use of a back balance weight.

(9) The skip cars are so devised as to permit dumping either from the side or the end.

(10) The method of producing slabs of granite 18 ins. thick and 15 ft. long by plug holes driven clear through the rock, is worthy of notice.

Characteristics of Quarries.—The Aberdeenshire quarries are of a characteristic oval outline in plan, and of a deep pitlike section, of which Rubislaw and Kemnay Quarries may be termed as typical, Figs. 1 and 2. These quarries are the largest granite quarries in the United Kingdom, and have each a depth of over 300 ft., which is gradually being increased. The commercial granite is found in "posts" or isolated masses cut off from each other by "bars" of inferior and even worthless rock, and the joints are highly irregular, features which make the quarrying of Aberdeenshire granites a difficult matter, and the principles of quarrying strictly indefinable. Overlying the granite is a more or less thick covering of exceedingly hard boulder clay, and for some distance down the surface rock is usually of inferior quality, owing chiefly to the decay of the felspar. The overburden is thus costly to remove, and the top rock unremunerative. Under these circumstances, the main principle underlying the development of the Aberdeenshire quarries is to work downwards, after a sufficient area has been opened out in which to locate the relative positions of good rock, "bars," and "master" joints, and to afford ample room for carrying on quarrying operations. As a rule the quality of rock also improves with the depth, and there is thus a temptation to deepen without a proportionate surface area. Where this has been done the quarry has assumed the form of a conical pit with a small floor, difficult and costly to work, and in some cases finally abandoned for these reasons.

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*Abstract of a paper read before the Institution of Mechanical Engineers of Great Britain at the Aberdeen, Scotland, meeting in July, 1907.

Sinking.—After a sufficient top area has been opened out in which to conduct operations, the quarry is deepened by sinking in successive benches or "dips" of about 40 ft. to 60 ft. at a time, and if possible the actual depth of the "dip" is determined by a natural horizontal bed-joint, so as to facilitate the excavation of the rock, but, should this not be met with, a "dip" is rarely carried down more than 70 ft.

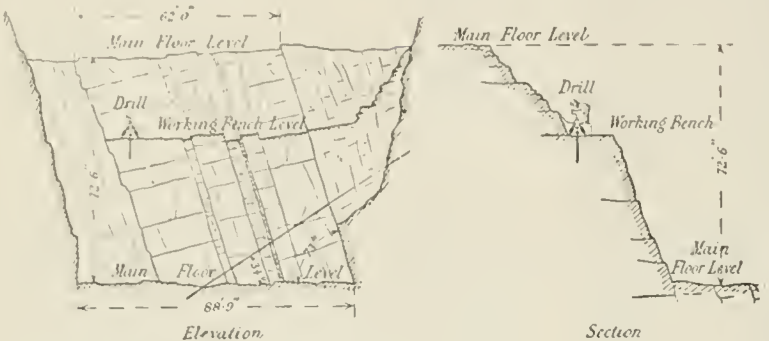

Fig. 3.—Typical Working Face.

In working out a "dip," a shaft is first opened at an extreme point of the quarry floor close up to the side or wall of the quarry, and from this shaft operations are extended outwards, until the whole area of the floor has been excavated to the level of the new "dip." The shaft is sunk as quickly as possible the full depth to the main bed-joint, and is opened out laterally to meet the "master" joints traversing the quarry in the direction of working, and thus obtain the best possible working face bounded by rock-joints. The presence of such joints largely determines the direction in which the rock is to be excavated, and a working face assumes the appearance shown in Fig. 3.

Excavation.—The rock is removed by boring and blasting, and for this purpose the working face is usually divided into two benches. The top bench is first worked back to meet a good vertical joint, a distance generally of from 20 ft. to 30 ft. from the face, after which the bottom bench is excavated and the rock entirely removed down to the level of the floor of the "dip," Fig. 3 (section). Vertical shot-holes up to 21 ft. deep are used to blast out the upper parts of the benches, and "breast" holes to remove the basal parts of the working face where there are no bed-joints. These latter are placed at an inclination of about 10° to 15° to the horizontal, and are drilled up to 21 ft. long, the nature of the rock may require, Fig. 4, and are calculated to increase the efficiency of the blast and level up the quarry floor. As it is not convenient to use the ordinary rock-drill tripod for such holes, a special frame made of timber is employed for this purpose on which the rock-drill is mounted, the frame being loaded with stones to steady it, Fig. 5. As the rock is blasted out the blocks are lifted from the working face by cranes and cableways, but the larger masses, beyond the power of the lifting appliances, are further broken up as they lie.

Rock-drilling.—The drilling of shot-holes is done by power-drills worked either by steam or compressed air. Hand-drilling is only resorted to where it is impossible or inconvenient to use a machine-drill, as in bringing down dangerous parts of the quarry wall. The machine-drills are chiefly of the Ingersoll or Henderson (Aberdeen) types, and the usual motive power is steam. At Kemmay Quarries air-drills have been in use, along with steam, for several years, and the installation is being further extended, while at Rubislaw Quarry a complete new air-compressing plant, of the Ingersoll-Rand type, driven by a 100 H. P. shunt-wound electric motor, has quite recently been laid down for exclusively working the rock-drills, the pressure being 100 lbs. per sq. in.

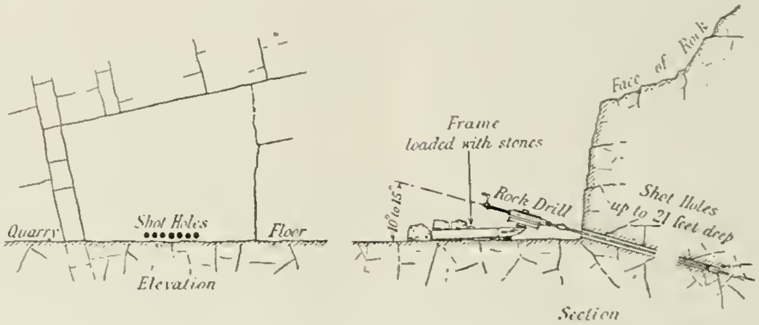

Fig. 4.—Sections Showing Arrangement of Holes.

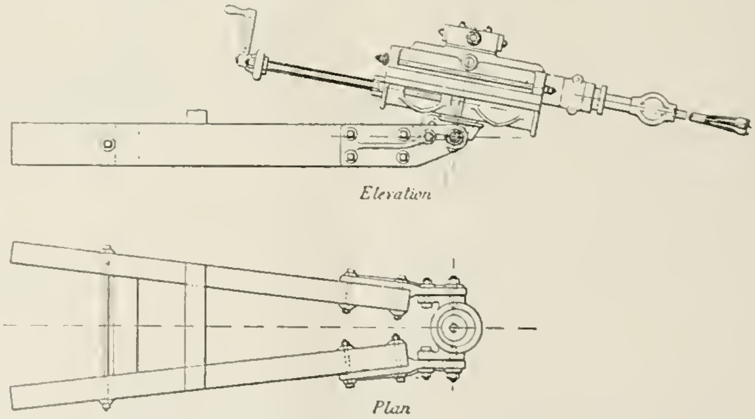

Fig. 5.—Mounting for Drill for Breast Holes.

In the smaller quarries steam is exclusively used for the rock-drills, and is found to be economical. When steam is used the supply is obtained from a central boiler-house situated on the quarry bank, the main steam-pipe being carried down the quarry wall to the floor, where a branch of wrought-iron piping is taken off to supply the drills, terminating at each drill in a length of flexible metal hose-pipe. As the working face recedes from the main pipe, new lengths are coupled on to the branch pipe to follow up the drills. A considerable loss of power thus takes place when the line of steam-pipe is long, and in the larger quarries the air-worked drills are considered to be more economical, if the work is not intermittent. . .

The drill-bits used are the chisel, + and Y forms. The practice of the various quarries in the application of these bits to drill a hole differs considerably, some preferring to use almost exclusively the + bit throughout, but, more commonly, holes are started with + or Y bits and finished, if deep, with chisel-bits for about the latter half of the hole. The results, however, in the speed of drilling do not vary much, as a hole 21 ft. deep takes on an average about a working day of 10 hours to complete under ordinary circumstances, the speed of drilling being higher than this average at the beginning, and less at the end.

In drilling a shot-hole a change of bit is made at every foot of depth drilled, and the sucessive diameters are gradually decreased by 1-16 in., owing to the conicity of the hole caused by the wear of the bit, so that a hole 21 ft. deep started with a

3¼-in. diameter bit terminates with one 2 in. diameter. Water is removed from the shot-holes by a small iron closed bucket, from 9 ins. to 18 ins. long, made from a piece of tube 1½ ins. diameter, let down by a light chain, and the cludge by a sludge-pump, and cludge-spoons of various lengths. The sludge-pump consists of a piece of iron tube from 4 ft. to 6 ft. long, and 1¼ ins. diameter, fitted with a plunger and long iron handle. The end is conical. with an inlet hole of ⅜-in. diameter.

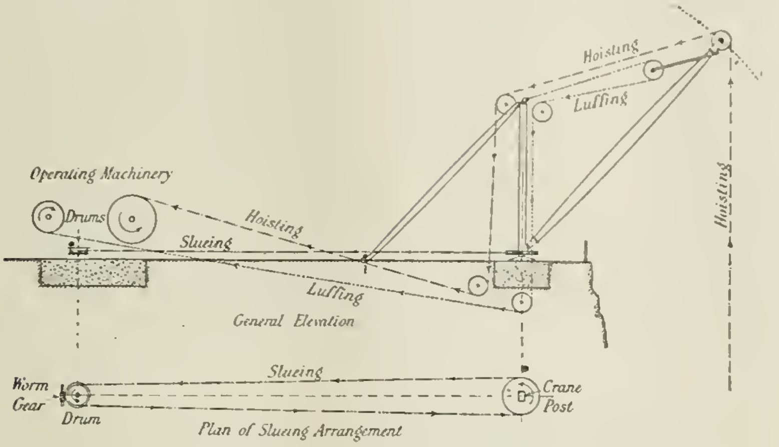

Fig. 6.—Arrangement of Cranes.

Blasting.—In granite quarrying the main object is to obtain large blocks, and explosives must therefore be applied judiciously and in a sparing manner. Coarse gunpowder is used in the Aberdeenshire quarries for blasting purposes, as higher-grade explosives, such as dynamite and gelignite, shatter the rock too much, and are not used at all, except to blast away bad rock or in very wet places. No general formula can be given to determine precisely the amount of the charge for a blast, owing to the very irregular nature of the rock, but it is estimated that one pound of gunpowder should produce 8 tons of rock under ordinary conditions of quarrying. In blasting out a long face, vertical holes are drilled right down to the horizontal bed-joint, and at a distance back from the working face generally equal to their depth, and small charges of gunpowder used, the object being to "heave" the mass on its bed without shattering it If one end of a working face is "bound," as is sometimes the case, a narrow trench is blasted forcibly out between the quarry wall and the working face to permit this method of blasting being carried out. The mass having thus been "shaken" and the joints developed, it can be blasted off into smaller blocks, and dragged from the face. For "breast" blasting, where there are no natural bed-joints, the shot-holes are usually placed in line close together with about 1½-ins. of clearance between each at top, Fig. 5, but both the position and number are decided by the actual rock-joints, and the quantity of material to be dislodged. Groups of three, five, and seven holes are common, and these may be drilled parallel, radially or in different planes. If dry, vertical shot-holes are filled directly from the top with loose powder passed through a copper filler, but in the case of wet holes, both vertical and inclined, the powder is made up into a cartridge by filling it into thin waterproof tubing, and tying the ends securely. Dry "breast" holes are loaded from a piece of open end copper tube, 1½ ins. diameter, fixed on the end of a long timber rod. The regular shot-holes are fired electrically, and the detonator or electric fuse is placed about 9 ins. from the surface of the charge in the loose holes, and is tied up with the cartridge in wet holes. At some quarries a time fuse is also inserted into the charge of each shot-hole as a safeguard against electrical misfire. The charge is rammed home with a timber ramrod, and the holes are stemmed or tamped with granite dust. The electric wires of the shot-holes are connected up "in series," this method being preferred to that of "in parallel," and the charges are fired by a high-tension electric exploder. The firing is done either during meal-hours, or when work has been stopped for the day, unless the nature of the blast is such that the men can readily find safe cover in the quarry. A steam-jet is used at some of the quarries for effectively washing out the tamping and charge of a misfit shot-hole, instead of boring a new one alongside.

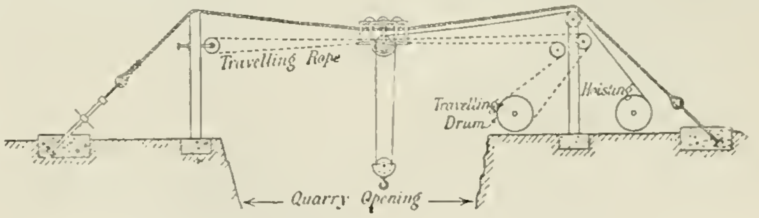

Fig. 7.—Diagram Showing End less Traveling Rope.

Hoisting.—The great depth and steepness of the Aberdeenshire quarries necessitates the hoisting of all quarried materials to the surface direct by means of cranes and cableways. In the smaller quarries the cranes are confined entirely to the bank, and do all the hoisting necessary with the assistance of cableways, but in the larger quarries additional cranes are placed on the quarry floor to hoist the stone from the working face of the "dip," and bring it within reach of the bank cranes, and if necessary the cableways, Figs. 1 and 2. Where there are a number of floor-cranes they are placed within continuous reach of each other to facilitate the transport of materials to the most suitable bank-crane or the stone-dressing spaces on the quarry floor. Floor-cranes are lowered with each successive "dip," if the floor is worked completely out, but bank-cranes are usually permanent as regards position. Cableways are arranged in such positions as will intersect the working face and give delivery of materials at convenient points on the banks, but may be shifted from time to time to suit the development of a working face or changes in surface arrangements.

Cranes.—Steam derrick-cranes are used for winding from the quarry bank, with the exception of Rubislaw Quarry, where electricity is the motive power. The cranes are placed close to the edge of the quarry on a pier of granite masonry, so as to give full effect to the jib, and afford the operator a clear view, and the back legs are loaded by building them into granite piers. The usual lift of such cranes is 5 tons, 10 tons, and 15 tons, and steel-wire ropes are used exclusively. The essential features of the more modern type of crane used for bank winding are long jibs, large drums for deep winding in excess of present requirements, powerful engines and gear for quick winding, slueing, and luffing, powerful burden and wind brakes, and the whole of the gear within easy reach of the operator. In the more recent cranes the mast and jib are of steel. The general design of such cranes requires to be heavier than that of a similar crane doing ordinary work, for, in adition to simple lifting, they are constantly used to drag rough stones over the quarry floor, and to "break out" locked stones from a working face after a blast. Accidents to jibs are not infrequent, and many quarry masters prefer timer instead of steel for this purpose, as a timber jib can readily be removed at the quarry workshop On the quarry-floor ordinary steam or electrical derrick-cranes are used, but in a number of quarries a modification of the derrick is to be found in the "all-round" crane. This type of crane has no back legs, and is supported from the top of an extra long trussed mast by a series of radial wire ropes, generally eight in number, which are anchored to the sides of the quarry, quite clear of the jib. This arrangement is economical of floor space, and allows the jib to revolve completely round. Cranes of this type are to be found in Kemnay, Rubislaw, and other quarries, Figs. 1 and 2. The floor cranes vary in power from 5 tons up to 10 tons and 15 tons, and either steam themselves, or are supplied from a central boiler-house on the quarry bank. An objection to self-steaming cranes on the floor arises from the black smoke in thick weather obscuring the view of cableway and crane operators on the bank, and is particularly felt in deep quarries of small area. The floor cranes in Rubislaw Quarry were originally steamed from the quarry bank, but have been recently converted into electrical machines by replacing the engines of each crane with a series-wound motor of 25 H. P. at 440 volts, and with controller and cast-iron resistances.

Large Power-Cranes.—Where very large stones for monumental and engineering purposes are quarried, a bank crane of special capacity has been laid down. Figure 6 shows the general arrangement of a crane of this kind, made by Messrs. James Abernethy & Co., Aberdeen, for Rubislaw Quarry. The lifting power is 20 tons at a speed of 50 ft per minute. The winding machinery is quite separate from the framework, and is placed in a house close to the quarry edge, and was formerly operated by steam, but now by a Siemens Brothers shunt-wound electric motor of 75 H. P. at 440 volts, with reducing gear of 2 to 1 between. Separate brake gear is provided for all the drums, and a wind brake for slueing. A steam crane of simliar power and capacity is to be found at No. 1 Quarry, Kemnay.

Cableways.—The successful commercial working of the Aberdeenshire Quarries would be impossible at present without aerial cableways, or "blondins" as they are familiarly termed, and their introduction is due to the late Mr. John Fyfe proprietor of Kemnay Quarries, who designed and erected, at No. 1 Quarry, Kemnay, the first modern cableway in this country. Two types of cableway are used, namely "horizontal" and "inclined," the former of which has two masts between which the main cable is stretched, Fig. 2, and the latter one mast only, the main cable being hung between it and a point much lower down on the quarry wall, and there anchored to the rock, Fig. 1. The main cable of this type is usually steeply inclined towards the quarry floor, necessitating the traveling of the load on the incline, but has the considerable advantage of being easily shifted, within limits, radially to the mast when necessary to follow up a working face. Fig. 7 shows diagrammatically the arrangement of ropes and drums essential to a quarry cableway, and comprises a main span rope on which the load carriage is traveled, a hoisting rope leading to a winding drum, and an endless traveling rope coiled a few times round another drum. In the more recent quarry cableways of long span an additional rope, called a "button" rope, about 5/8-in. diameter, is hung above the main cable for the purpose of supporting and guiding the hoisting rope, and is provided with buttons or stops at intervals. Light iron hangers are carried on the horn of the load carriage, each having a loop corresponding to a special stop on the button-rope, and as the carriage recedes from the mast the hangers are caught and spaced out over the span, to be again picked up by the horn on the return journey. The load carriage is a light steel frame of flat bars with three wheels traveling on the span rope, and an extra wheel on the button rope. From it are hung directly the hoisting sheaves, and the endless traveling rope is attached to each end, Fig. 8. To suit the carriage to the varying inclinations of the span rope, and equalize the load, two of the main wheels are placed on an equilibrating lever within the main frame. The masts are of timber, and carry the sheaves at top and bottom for leading the hoisting and traveling ropes to the engine-house.

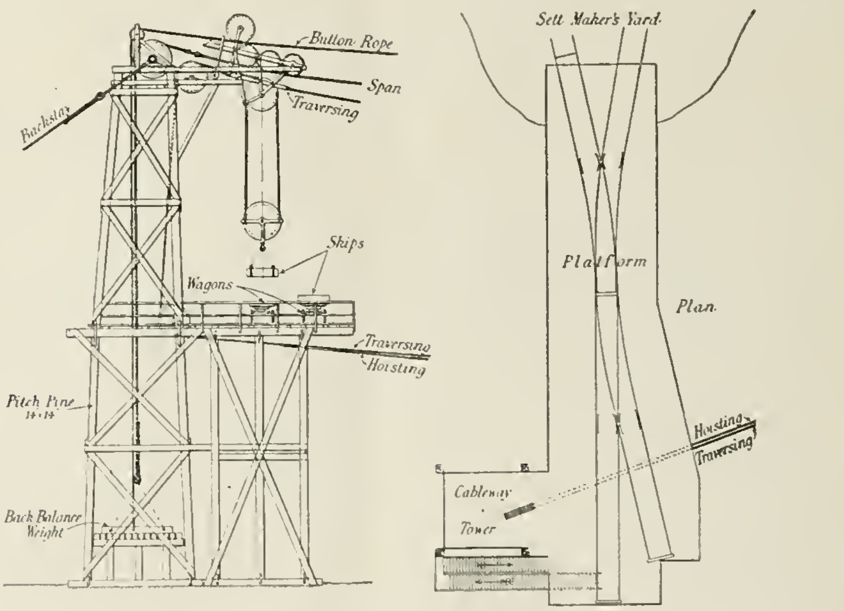

Fig. 8.—Diagram Showing Operation of Back Balance on Cableway.

Under special conditions of height and load, masts are strengthened at the base by braced timber trestle work, or built entirely as braced timber towers, as at No. 1 Quarry, Kemnay, Fig. 2 and Fig. 7, where the span is 945 ft. and the load 8 tons. To avoid departing from the simple form of mast in such cases, at many of the quarries a pier of dry-built granite masonry is raised to the required height, and on this the mast is placed without further modification. The masts are usually anchored by wire-rope backstays, connected to concrete or masonry blocks with adjusting screws between, but in some cases the main cable is passed over a pulley ,and a back balance weight suspended from the end, somewhat in excess of the working load of the cableway, so that, should an overload be attempted, the back balance will be hoisted instead, Fig. 8. Five tons lifting capacity is found to be a serviceable working load for a quarry cableway, but the older machines lift about three tons, and at Sclattie Quarry a comparatively recent cableway of about 575 ft. span, has a lifting capacity of 12 tons.

The winding machinery for a quarry cableway consists of two drums, 5 ft. diameter, for the hoisting and traveling ropes respectively, but which are worked independently, so that the load can be hoisted without traveling when necessary. In traveling the load, however, the two drums are run together the hoisting rope being wound on at the same speed as the endless rope is traveling. The engines have two cylinders, 11 in. diameter, by 18 in. stroke, and are capable of lifting and traveling the load at speeds of 300 and 90 ft. per minute respectively. In every case the winding machinery is placed close to the edge of the quarry, so that the operator has full command of the floor, and is thus frequently at a considerable distance from the mast itself, in which case guide pulleys are used to lead the various ropes into the engine-house. Steam is the motive power for the cableways at all quarries, except Rubislaw, where they are electrically driven.

Drainage.—The pit-like character of the Aberdeenshire quarries precludes any natural system of drainage being adopted, and the whole of the water has to be raised to the bank by pumps. The usual practice is to excavate a sump hole at the extreme end of a "dip" and drain the water from the quarry floor to it. The drainage pump is placed on a ledge of rock a few feet above the level of the sump hole, and is housed in to protect it from damage by blasting, or falling stones. In the smaller quarries the pump is often fitted up on a frame of timber sleepers, and is hoisted to the bank out of danger when the shots are to be fired, or if in the way of operations. As a rule, the smaller quarries have not a great deal of leakage water to contend with, but the larger and deeper quarries require more or less constant pumping. As the granite rock is practically impervious a spell of wet weather or a period of thaw entails heavy pumping. The type of pump generally in use is the horizontal, direct-acting, steam pump, steamed from the central boiler-house at the quarry bank. The suction-pipe is short and consists of thick armored rubber hose with a long rose box, and can be adapted to a shallow or irregular sump in the early stages of opening out a "dip." The discharge main is of steel piping with screwed flanges, suspended by wire ropes alongside the wall of the quarry. At No. 1 Quarry, Kemnay, where a large amount of water has to be dealt with, a direct-acting steam-pump is used, capable of throwing 7,000 gallons per hour, and at Rubislaw Quarry a turbine pump by Mather and Platt, of Manchester, has recently been laid down capable of delivering 7,500 gallons per hour to 400 ft. at 1,360 revolutions per minute, and is driven direct by a 60 H. P. shunt-wound electric motor at 440 volts.

Cost of Erecting a Draw Bridge of 236-ft. Span.

This bridge has a span of 236 ft., and a length of 239 ft. over all. Trusses are 16 ft. c. to c., and the depth of truss is uniform and 25 ft. c. to c. of chord pins. The center panel is 16 ft. and the remaining 10 panels are each 22 ft. The bridge is designed to be turned by hand only, and has a drum 22½ ft. x 4¾ ft. The bridge was designed for a live load of 3,300 lbs. per lin. ft.

The total weight of the metal is 433,300 lbs., distributed as follows:

	Lbs.
Trusses	205,600
Lateral bracing	20,000
Floor system	107,000
Turntable—	
Drum (22½ ft. diam.)	21,400
Wheels (46)	16,200
Track	11,100
Rack	4.900
Tread pls.	5,200
Gearing and journal boxes	25,400
End lift	10,200
End supports	6,300
Total	433,300

The itemized cost (to the contractor) of erection was as follows:

	General Expense:	
7.5	days, foreman at $5.00	$ 37.50
44	days, bridgemen, at $3.00	132.00
34	days, laborers, at $2.00	68.00
10	days, watchman, at $2.00	20.00
3	days, blacksmith, at $3.00	9.00
98.5.	Total labor, at $2.67	$266.50
	3,000 ft. B. M. in traveler at $25	75.00
	Total	$341.50

Thus $341 includes the cost of erecting a derrick to unload the steel from cars, the labor of making and erecting traveler.

	Erection of Steel Work:	
19	days, foreman, at $5.00	$ 95.00
110	days, bridgemen, at $3.00	330.00
80	days, riveters, at $3.00	240.00
73	days, heaters and buckers, at $2.00	146.00
84	days, laborers, at $2.00	168.00
366.	Total labor, at $2.65	$969.00
30	days' rent of hoisting engine, at $3.00	90.00
10	tons coal, at $3.00	30.00
	Total	$1,089.00

The engineman received the same wages as the bridgemen and was classed with them.

3	days, foreman, at $5.00	$ 15.00
9	days, bridgemen, at $3.00	27.00
80	days, painters, at $2.50	200.00
92	days total labor	$242.00
	Total materials and labor	$337.00
	Timber Deck (17,000 ft. B. M.):	
3	days, foreman, at $5.00	$15.00
26	days, carpenters, at $2.75	71.50
3	days, laborers, at $2.00	6.00
32	days total labor at $2.90	$92.50

It will be noted that the labor of framing and placing the timber deck (i. e., the ties, guard rail, etc.), cost $5.50 per M, or 38 cts. per lin. ft. of bridge.

There is clearly some error in the amount of red lead and oil above given. By comparing with figures given on page 563 of Gillette's Handbook of Cost Data, this fact is well brought out. Since the bridge weighed 433,000 lbs., or 216.5 tons, the cost per ton for erection may be summarized as follows:

General Expense:		Per Ton.
Labor	$266.50	$1.23
Material for traveler	75.00	0.35
Erecting Steel:		
Labor	$969.00	$4.49
Rent of engine	90.00	0.42
Coal for engine	30.00	0.14
Painting:		
Materials	$ 95.00	$0.44
Labor	242.00	1.11
Timber deck	$ 92.50	$0.42
Total	$1,860.00	$8.60

This work was done by a contractor who received $12 per ton for erecting the bridge. Practically no falsework was necessary, since the bridge was erected upon the "draw protection," which served as a falsework.

The bridge metal cost 4 cts. per lb. f. o. b cars, ready for erection, and, since the contract price was 0.6 cts. for erection, the total was 4.6 cts. per lb. in place, or $19,931 for the total superstructure, exclusive of the timber deck. This is equivalent to nearly $85 per lin. ft. There were nearly 70 ft. B. M. per lin. ft. of timber deck (ties and guard rail), which cost $20 per M, or $1.40 per lin. ft. of bridge.

For comparative figures on the cost of steel bridges, the reader is referred to our issues of Apr. 3, Apr. 10, Apr. 17, and May 8.

Because of the estimated deficit in the operation of the Chilean State railways for 1907, the minister of public works has issued an order advancing the freight rates 30 per cent. The deficit in 1906 was $888,539 United States gold, and the estimated deficit under the old rates was $4,020,000 United States gold.

LETTERS TO THE EDITORS.

The Cost of Drilling and Blasting Soft Shale Rock Under Water.

Sir:—Referring to the article on the above subject published in your issue of Aug. 7, I would advise you that in the day record for drilling and blasting, drill boat "A" had 30 transfers by tug, whereas drill boat "B" had but 7 transfers in each shift, for the reason that drill boat "A" was working in an exposed location, whereas drill boat "B" was working in a comparatively sheltered position, also drill boat "A" worked only days and would therefore have two transfers from and to the harbor each day that the weather was favorable to work, while drill boat "B" in favorable weather would remain at the site of the work continuously, working both day and night.

The repairs consisted of repairing the hoisting engine, repairing hydraulic lift, repairing anchor shaft-coupling, repairing drill, taking line out of tug's wheel, repairing bottom of boat's hull which had a hole blown in it by a stick of dynamite which came out of a drilled hole without being seen by the crew and exploded directly under the hull. These repairs do not include the cost of sharpening drills, as this is charged to labor, drilling and blasting. The drill sharpening was practically all done during the day shift and there was no night blacksmith employed.

One hole only was, as a rule, fired at a time, and the blasters would fire the holes as fast as they were drilled.

Referring to the number of drills sharpened in the week with drill boat "B," it may be stated that the total drilled holes for day and night shifts combined was 8,222 ft., and the number of drills sharpened was 71, making one drill sharpened for each 116 ft. of hole drilled. Yours truly,

E. C. Bowen, Jr.,
Ashtabula Harbor, O., Aug. 6, 1907.

Announcement has been made that Ambrose Channel, through the outer bar across the entrance to New York harbor between Sandy Hook and Coney Island, will be buoyed and ready for use by Sept. 1. It will enable the largest ships to reach the upper harbor full laden by a direct route six miles shorter than the present channel without having to wait for favorable tides. The new channel is seven miles long, about 1,000 feet wide and 40 feet deep. It extends across the outer bar to deep water just outside the Narrows. When complete in every particular, in about four years' time, this new waterway will be double its present width.

The Belgian government has set aside $9,600,000, the last installment of the $28,200,000 allotted for the improvement of the harbor at Antwerp. It is proposed to construct elaborate fortifications as well as ample dockage.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0310. **Thermit Welding.**—Goldschmidt Thermit Company, New York, N. Y.

The use of Thermit for welding steel and iron castings, railway rails and all kinds of forged steel structures, is known in a general way to most of our readers. In this pamphlet the company named above describes and illustrates the process adopted in welding locomotive frames, wrought iron and steel pipes and rods, street railway rails, and iron and steel castings. The tools and materials used in these several classes of work are described, and there is also a general description of Thermit and the process by which it does its welding work.

No. 0311. **Wire Rope.**—Broderick & Bascom Rope Company, St. Louis, Mo.

The principal part of this pamphlet consists of tables of sizes, dimensions and make-up of the various types of wire rope manufactured by this well-known firm. There are also a number of pages devoted to notes on the use of wire rope and discussions of the design of sheaves for carrying wire rope. Sections on splicing, on wire rope haulage, and on aerial wire rope tramways are also contained in the pamphlet.

No. 0312. **Locomotives.**—American Locomotive Company, New York, N. Y.

This is one of the regular series of pamphlets being issued by this company describing and illustrating the various types of locomotives which it manufactures. In this particular pamphlet the six-wheel type of switching locomotive is described. The arrangement is to illustrate the locomotive on one page and to give on the opposite page, in tabular form, all the essential dimensions and structural features. A score or more of different locomotives are so illustrated and described.

No. 0313. **Vitrified Pipe Culverts.**—Blackmer & Post Pipe Company, St. Louis, Mo.

In this pamphlet the above named manufacturers of Vitrified Pipe have endeavored to tell how to attain the best results through the use of vitrified pipe in the construction of culverts under railroads. A general discussion of the characteristics of a good vitrified pipe is given and this is followed by line drawings and text illustrating and describing the construction of pipe culverts under various conditions. The pamphlet is well worth securing and reading by anyone interested in the use of vitrified pipe for culvert work.

No. 0314. **Deep Well Pumps.**—Cook Well Company, St. Louis, Mo.

This company has long been known as a manufacturer of a standard line of machinery for deep well water supplies. The pamphlet contains descriptions of deep well pumps, strainers, valves and supplies of all kinds. Each of these several devices is illustrated and a table is given showing its principal dimensions and its list price.

No. 0315. **Road Rollers.**—Kelly-Springfield Road Roller Company, Springfield, O.

In this pamphet the company named above, which manufactures a full line of Road Rollers, illustrates a number of its most popular designs. The descriptive portion of the catalog is very brief, but the illustrations are excellently worked out and give a very clear idea of the chief characteristics of the machine.

No. 0316. **Concrete Mixers.**—The Hains Concrete Mixer Company, Washington, D. C.

The Concrete Mixer described in this catalog is of the gravity type. It consists of a number of hoppers placed one above the other through which the material falls, being mixed during the journey. There are a number of illustrations showing the use of the mixer on the great Connecticut Avenue bridge recently completed at Washington, and also a number of diagram illustrations illustrating the application of the mixer to various conditions under which concrete work may have to be done. One of the new features is the telescope mixer which can be hung from the arm of the derrick and operated without any staging or structure of any sort.

Personals.

Snow & Webster Engineering Corporation, constructing engineers, will on August 19 occupy their own building at 147 Milk street, Boston, Mass.

Mr. W. J. Watson, M. Am. Soc. C. E., has resigned his position as bridge engineer of the Osborn Engineering Co., to engage in general construction work.

Mr. Walter Moorehouse, formerly with the Cincinnati Northern Traction Co., has been appointed assistant superintendent of construction for the projected electric railway from Buffalo, N. Y., to Erie, Pa.

Mr. R. D. Beman, of Meadville, Pa., has been appointed Deputy State Highway Commissioner of Pennsylvania. Other appointments made in accordance with the act recently passed by the legislature reorganizing the State Highway Department are as follows: Assistant Commissioner, G. W. Ensign, Warren, Pa.; Engineers: G. H. Biles, Philadelphia; C. W. Bosley, Hollidaysburg; E. D. Garrett, Downingtown; J. T. Gephart, Lancaster; F. F. Hallam, McKeesport; C. F. Hamilton, Franklin; C. W. Hardt, Camp Hill; S. W. Jackson, Meadville; A. W. Long, Scranton; J. R. Wilson, Washington; W. A. Wynn, Pittsburg. Mr. C. E. Douglass, New Castle, Pa., was appointed Chief Draftsman.

Professor William Freeman Myrick Goss, who has just accepted the position of Dean of the College of Engineering of the University of Illinois, was born in Massachusetts in 1859 and received his certificate of graduation from the Massachusetts Institute of Technology in 1879. He received the degree of Master of Science from Wabash College in 1884 and the honorary degree of Doctor of Engineering was conferred upon him by the University of Illinois in 1904. In 1879 he was called to Purdue University to organize there the department of practical mechanics. Since 1890 he has been Dean of the Schools of Engineering and Director of the Engineering Laboratory at Purdue. As a result of his successful work at that institution he has become recognized as an authority on many aspects of the steam engine and has won for himself an international reputation in the field of railway engineering. He is a member of the leading engineering and technical societies of the United States and is the author of several engineering books and various monographs of a scientific nature. Professor Goss is to take up his work at the University of Illinois Sept. 1st and will be Dean of the College of Engineering and Director of the School of Railway Engineering. This school is a newly organized one and the University intends to develop in it a complete and comprehensive scheme of training for the railway service, including railway organization and operation as well as railway engineering. The four following professorships have thus far been established: that of railway civil engineering; railway mechanical engineering; railway electrical engineering; and railway administration. Professor Goss will direct and develop this school as a part of the College of Engineering

CONTRACT NEWS

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BIDS ASKED.

Bridges.

Bids Open.		See Issue.
Aug. 21.	Cleveland, O.	Aug. 14
Aug. 21.	New York, N. Y.	Aug. 21
Aug. 22.	Chambersburg, Pa.	Aug. 14
Aug. 22.	Bloomsburg, Pa.	Aug. 14
Aug. 23.	Sandusky, O.	Aug. 7
Aug. 23.	Pittsburg, Pa.	Aug. 7
Aug. 24.	Lebanon, O.	Aug. 7
Aug. 24.	Lebanon, O.	Aug. 21
Aug. 24.	Terre Haute, Ind.	Aug. 21
Aug. 27.	Newark, N. J	Aug. 21
Aug. 28.	Washington, D. C.	Aug. 21
Aug. 31.	Lima, O.	Aug. 14
Sept. 2.	Tarboro, N. C.	July 31
Sept. 2.	Ashtabula, O.	Aug. 21
Sept. 2.	Jefferson, O.	Aug. 21
Sept. 3.	Ingot, Cal.	Aug. 21
Sept. 3.	Catlettsburg, Ky.	Aug. 21
Sept. 3.	Natchez, Miss.	Aug. 21
Sept. 4.	Glasgow, Mont.	July 31
Sept. 4.	Columbus, O.	Aug. 21
Sept. 9.	Paquemine, La.	Aug. 14
Sept. 16.	Madera, Cal.	Aug. 14
Sept. 30.	Santiago, Chile	July 17

Buildings

Aug. 21.	Ames, Ia.	Aug. 14
Aug. 21.	Fort Dodge, Ia.	July 31
Aug. 21.	Cass Lake, Minn.	Aug. 21
Aug. 21.	New York, N. Y.	Aug. 21
Aug. 22.	Des Moines, Ia.	Aug. 21
Aug. 22.	Jackson, Miss.	July 24
Aug. 22.	Jackson, Mich.	July 17
Aug. 22.	Orient, O.	Aug. 7
Aug. 22.	Negaunee, Mich.	Aug. 14
Aug. 23.	Washington, D. C.	Aug. 7
Aug. 23.	Portland, Me.	Aug. 14
Aug. 23.	Newark, N. J.	Aug. 21
Aug. 23.	New York, N. Y.	Aug. 21
Aug. 23.	Delaware, O.	July 31
Aug. 24.	McAlester, I. T.	Aug. 21
Aug. 24.	Geneva, Ill.	July 17
Aug. 24.	Fort Greble, R. I.	Aug. 21
Aug. 26.	North Chicago, Ill.	Aug. 21
Aug. 26.	McClelland, Ia.	Aug. 21
Aug. 26.	Republic, Mich.	Aug. 14
Aug. 26.	New York, N. Y.	Aug. 21
Aug. 26.	Toledo, O.	Aug. 14
Aug. 26.	Milwaukee, Wis.	Aug. 7
Aug. 27.	Trenton, N. J.	July 31
Aug. 27.	New York, N. Y.	Aug. 21
Aug. 27.	Springfield Township, O.	Aug. 7
Aug. 27.	Murfreesboro, Tenn.	Aug. 21
Aug. 28.	Portland, Ore.	Aug. 14
Aug. 28.	Anthony, Kan.	Aug. 14
Aug. 28.	New York, N. Y.	Aug. 21
Aug. 28.	Cleveland, O.	Aug. 14
Aug. 28.	Fort Smith, Ark.	Aug. 14
Aug. 29.	Peru, Ind.	Aug. 14
Aug. 29.	Wahpeton, N. Dak.	Aug. 7
Aug. 29.	Iowa City, Ia.	Aug. 7
Aug. 29.	Price, Utah	Aug. 21
Aug. 30.	Moscow, Idaho	Aug. 14
Aug. 31.	Egeland, N. D.	Aug. 21
Aug. 31.	Athens, O.	Aug. 21
Aug. 31.	Mansfield, O.	Aug. 21
Sept. 2.	Elkhart, Ind.	Aug. 21
Sept. 3.	New Fort Lyon, Colo.	Aug. 21
Sept. 3.	Cleveland, O.	Aug. 14
Sept. 3.	Watertown, N. Y.	July 31
Sept. 3.	Bloomfield, Ind.	July 31
Sept. 3.	Anthon, Ia.	Aug. 21
Sept. 3.	Washington, D. C.	Aug. 7
Sept. 3.	Bloomfield, Ind.	Aug. 7
Sept. 3.	St. George, S. C.	Aug. 21
Sept. 4.	Quincy, Mass.	July 31
Sept. 5.	Evansville, Ind.	Aug. 7
Sept. 9.	Cleveland, O.	Aug. 21
Sept. 11.	Eureka, Cal.	Aug. 14
Sept. 16.	Pittsburg, Pa.	Aug. 7
Sept. 16.	Buffalo, N. Y.	Aug. 7
Sept. 17.	San Francisco, Cal.	Aug. 14
Sept. 19.	Muscatine, Ia.	Aug. 14
Sept. 23.	Cedar Rapids, Ia.	Aug. 14
Sept. 24.	Hamilton, O.	Aug. 21
Oct. 1.	Pensacola, Fla.	Aug. 21

Roads and Streets.

Aug. 21.	Edgewater, N. J.	Aug. 21
Aug. 21.	Brooklyn, N. Y.	Aug. 14
Aug. 21.	Iowa City, Ia.	Aug. 21
Aug. 21.	Winchester, Ind.	Aug. 14
Aug. 21.	Aberdeen, Wash.	Aug. 14
Aug. 21.	Aberdeen, Wash.	Aug. 7
Aug. 21.	Fort St. Philip, La.	Aug. 7
Aug. 21.	New York, N. Y.	Aug. 14
Aug. 22.	Kansas City, Mo.	Aug. 14
Aug. 22.	Kansas City, Mo.	Aug. 14
Aug. 22.	Fort Wayne, Ind.	Aug. 21
Aug. 22.	Montpelier, Ind.	Aug. 21
Aug. 22.	St. Paul, Minn.	Aug. 21
Aug. 23.	Janesville, Wis.	Aug. 14
Aug. 23.	Mt. Gilead, O.	Aug. 14
Aug. 23.	Valparaiso, Ind.	Aug. 14
Aug. 23.	Milwaukee, Wis.	Aug. 21
Aug. 23.	Milwaukee, Wis.	Aug. 21
Aug. 23.	Mt. Gilead, O.	Aug. 21
Aug. 23.	Sullivan, Ind.	Aug. 14
Aug. 23.	Etna, N. J.	Aug. 14
Aug. 24.	Watertown, Wis.	Aug. 14
Aug. 24.	Prescott, Ariz.	July 31
Aug. 24.	West Carrollton, O.	Aug. 21
Aug. 26.	Pittsburg, Pa.	Aug. 7
Aug. 26.	Jacksonville, Fla.	Aug. 14
Aug. 26.	Union, N. J.	Aug. 21
Aug. 27.	Frankfort, Ind.	Aug. 14
Aug. 27.	Pensacola, Fla.	July 31
Aug. 28.	Hoboken, N. J.	Aug. 14
Aug. 28.	Hoboken, N. J.	Aug. 7
Aug. 28.	Hoboken, N. J.	July 31
Aug. 28.	Fort Lee, N. J.	Aug. 7
Aug. 29.	Smithport, Pa.	Aug. 14
Aug. 30.	Tipton, Ind.	Aug. 14
Aug. 30.	Marshfield, Mo.	Aug. 14
Aug. 30.	Cincinnati, O.	Aug. 7
Aug. 30.	Marshfield, Mo.	July 31
Aug. 31.	Ridgway, Pa.	Aug. 21
Aug. 31.	Greencastle, Ind.	Aug. 21
Sept. 2.	Sullivan, Ind.	Aug. 21
Sept. 2.	Salem, Ind.	Aug. 21
Sept. 3.	Beardstown, Ill.	Aug. 14
Sept. 3-4-5.	Albany, N. Y.	Aug. 14
Sept. 3.	New Philadelphia, O.	Aug. 7
Sept. 3.	Yorktown, Va.	Aug. 7
Sept. 3.	Indianapolis, Ind.	Aug. 21
Sept. 11.	Cleveland, O.	Aug. 21
Sept. 11.	Cleveland, O.	Aug. 21

Sewers.

Aug. 21.	North Chicago, Ill.	July 31
Aug. 21.	Aberdeen, Wash.	Aug. 14
Aug. 21.	Ann Arbor, Mich.	Aug. 21
Aug. 21.	Auburn, Ind.	Aug. 21
Aug. 22.	Kansas City, Mo.	Aug. 14
Aug. 22.	Fayetteville, Ark.	July 24
Aug. 22.	St. Paul, Minn.	Aug. 21
Aug. 23.	Delaware, O.	July 31
Aug. 23.	Des Moines, Ia.	Aug. 21
Aug. 24.	Beaver Dam, Wis.	Aug. 21
Aug. 26.	Baden, Pa.	Aug. 14
Aug. 26.	Bloomfield, Ind.	Aug. 21
Aug. 26.	Manchester, Ia.	Aug. 21
Aug. 26.	Warren, O.	Aug. 21
Aug. 27.	Oakley, O.	Aug. 21
Aug. 27.	Cleveland, O.	Aug. 21
Aug. 28.	Louisville, Ky.	Aug. 14
Aug. 30.	Fort Dade, Fla.	Aug. 14
Aug. 30.	Evansville, Ind.	July 24
Aug. 31.	Canal Dover, O.	Aug. 14
Aug. 31.	Elroy, Wis.	Aug. 14
Sept. 2.	Columbus, O.	Aug. 21
Sept. 3.	New Ulm, Minn.	Aug. 21
Sept. 5.	Monessen, Pa.	Aug. 21
Sept. 6.	Iowa City, Ia.	Aug. 7
Sept. 11.	New Orleans, La.	July 10
Sept. 13.	Lake Mills, Wis.	Aug. 21

Water Supply.

Aug. 21.	Springfield, Mass.	July 31
Aug. 21.	Fort Hancock, N. J.	July 31
Aug. 22.	Philadelphia, Pa.	July 31
Aug. 23.	Westboro, Mass.	Aug. 14
Aug. 23.	Du Quoin, Ill.	Aug. 21
Aug. 26.	Cumberland, Md.	Aug. 14
Aug. 26.	Ashland, O.	Aug. 7
Aug. 26.	Pleasantville, N. Y.	Aug. 21
Aug. 27.	Cincinnati, O.	July 31
Aug. 27.	Chicago, Ill.	Aug. 21
Aug. 29.	Philadelphia, Pa.	Aug. 14
Aug. 30.	Fort Dade, Fla.	Aug. 14
Aug. 31.	Chicago, Ill.	Aug. 14
Aug. 31.	Chicago, Ill.	Aug. 14
Aug. 31.	Chicago, Ill.	Aug. 14
Aug. 31.	Montgomery, Minn.	Aug. 21
Sept. 2.	Carrington, N. Dak.	Aug. 7
Sept. 3.	Kansas City, Mo.	Aug. 14
Sept. 3.	Victoria, B. C.	Aug. 14
Sept. 4.	New Orleans, La.	July 3
Sept. 6.	Montreal, Que.	Aug. 14
Sept. 7.	Pensacola, Fla.	Aug. 21
Sept. 14.	Norfolk, Va.	Aug. 21

Miscellaneous.

Aug. 21.	New York, N. Y.	Dock Work,	Aug. 14
Aug. 21.	Idaho Springs, Colo.,	Dam,	Aug. 21
Aug. 22.	Shawneetown, Ill.,	Levee Work,	Aug. 14
Aug. 22.	Blackwell's Island, N. Y.,	Electric Light Plant,	Aug. 14
Aug. 22.	New York, N. Y.,	Electric System,	Aug. 7
Aug. 23.	Newark, N. J.,	Electric Light Plant,	Aug. 14
Aug. 24.	Fort Greble, R. I.,	Concrete Coal Bin,	Aug. 14
Aug. 24.	Bremerton, Wash.,	Concrete Quay Wall,	July 24
Aug. 24,	Toledo, O.,	Monument,	July 31
Aug. 26.	Jacksonville, Fla.,	Jetty Work,	Aug. 7
Aug. 26.	Jacksonville, Fla.,	Jetty Works,	Aug. 14
Aug. 26.	Detroit, Mich.,	Lumber,	Aug. 14
Aug. 26.	West Point, N. Y.,	Street Lighting System,	Aug. 14
Aug. 27.	St. Peter's Bay, P. E. I.,	Breakwater,	Aug. 14
Aug. 27,	Cincinnati, O.,	Tracks, Grading, Etc.,	July 31
Aug. 29.	Fort Lawton, Wash,	Corrals,	Aug. 14
Aug. 30.	Philadelphia, Pa.,	Suction Dredges,	Aug. 7
Aug. 30.	New York, N. Y.,	Iron Flagstaff,	Aug. 21
Aug. 31.	Galveston, Tex.,	Jetty Work,	Aug. 7
Aug. 31.	Lebanon, Pa.,	Street Lighting,	July 24
Aug. 31.	Rushville, Ind.,	Crushed Stone and Gravel,	Aug. 21
Sept. 1.	Webb City, Mo.,	Railroad,	July 31
Sept. 2.	New York, N. Y.,	Rubble Stone, Dikes,	Aug. 21
Sept. 3.	Winnipeg, Man.,	Hydro-Electric Development,	June 19
Sept. 3.	Two Rivers, Wis.,	Pier Work,	Aug. 14
Sept. 3.	Joliet, Ill		Aug. 21
Sept. 4.	Providence, R. I.,	Dredging,	Aug. 14
Sept. 4.	Baltimore, Md.,	Disposition of Garbage,	Aug. 21
Sept. 10.	Fairport, O.,	Breakwater,	Aug. 14

Sept. 10. Cleveland, O., Breakwater, Aug. 14
Sept. 10. Bar Harbor, Me., Breakwater, Aug. 21
Sept. 11. Cincinnati, O., Dike and Dam, Aug. 21
Sept. 30. Washington, D. C., Search Light Outfit, Aug. 7
Oct 5. Franklin Shoals, Ark., Lock and Dam, Aug 7
Oct. 5. Mobile, Ala., Locks and Dams, Aug. 14
Oct. 5. Franklin., Ark., Aug. 14
Oct. 5. Vicksburg, Miss., Lock and Dam, Aug. 14

Excavation, Earth and Rock.

Aug. 22. Brunswick, Ga., Dredging, July 24
Aug. 23. Savannah, Ga., Dredging, July 31
Aug. 23. Boston, Mass., Dredging, Aug. 21
Aug. 24. Decatur, Ind., Ditch Works, Aug. 21
Aug. 26, Fort Washington, Md., Grading, Draining, July 31
Aug. 26. New York, N. Y., Embankment, July 31
Aug. 26. Block Island, R. I., Dredging, Aug. 7
Aug. 26. National Soldiers' Home, Va., Filling, Aug. 14
Aug. 26. Detroit, Mich., Hire of Plant, Aug. 14
Aug. 26. North Chicago, Ill., Grading, Aug. 14
Aug. 30. Portland, Me., Rock Excavation, Aug. 7
Sept. 2. Tacoma, Wash., Dredging, Aug. 7
Sept. 3. Ft. Snelling, Minn., Ditch Work, Aug. 14
Sept. 3. Joliet, Ill., Excavation, Concrete Walls, Aug. 21
Sept. 4. Providence, R. I., Dredging, Aug. 7
Sept. 4. Norfolk, Va., Dredging, Aug. 14
Sept. 4. Providence, R. I., Dredging, Aug. 14
Sept. 4. Woonsocket, S. D., Drainage Ditch, Aug. 21
Sept. 5. Seattle, Wash., Dredging, Aug. 14
Sept. 7. Little Rock, Ark., Dredging, Concrete Conduit, Aug. 21
Sept. 7. Washington, D. C., Dredging, Aug. 21
Sept. 7. New London, Conn., Dredging, Aug. 21
Sept. 10, Sibley, Ia., Ditch Work, July 31
Sept. 10. New Orleans, La., Dredging, Aug. 21

Materials, Machines, Supplies, Tools Etc

Aug. 21, Tompkinsville, N. Y., Moorings, July 31
Aug. 21. Chicago, Ill., Iron Fence and Gates, Aug. 21
Aug. 22. Tompkinsville, N. Y., Lantern, Aug. 7
Aug. 22. Washington, D. C., Engine, Tank, Etc., Aug. 7
Aug. 22. Philadelphia, Pa., Special Castings, Aug. 14
Aug. 23. Newark, N. J., Electric Equipment, Aug. 7
Aug. 23. Chicago, Ill., Iron and Steel Poles, Aug. 21
Aug. 26. Washington, D. C., Steel Barges, Etc., Aug. 14
Aug. 26. Detroit, Mich., Fir Timber, Aug. 7
Aug. 29. San Francisco, Cal., Motors, Chain Drives, Etc., Aug. 7
Aug. 26. New York, N. Y., Vacuum Cleaning System, Aug. 21
Aug. 27. New York, N. Y., Sand and Broken Stone, Aug. 21
Aug. 27. New York, N. Y., Machine Tools, Aug. 21
Sept. 3. Kansas City, Mo. Pipe and Specials, Aug. 7
Sept. 3. Kansas City, Mo., Steel Pipe, Aug. 7
Sept. 3. Puget Sound, Wash., Piles, Timber, Etc., Aug. 14
Sept. 3. Mare Island, Cal., Pipe, Lamps, Valves, Etc., Aug. 14
Sept. 5. River Falls, Wis., Fire Hose, Aug. 21
Sept. 8, Louisville, Ky., Pumping Engines, July 31
Sept. 14. Manila, P. I., Valves, Gates, July 31

BIDS ASKED.

Bridges.

Items Arranged Alphabetically by States.

Ingot, Cal.—Bids are asked until 10 a. m., Sept. 3, by the Board of Supervisors, S. N. Withrow, Clerk, for the construction of a stringer and truss bridge across Cow Creek at Ingot.

Washington, D. C.—Bids are asked by D. W. Ross, General Purchasing Officer, Isthmian Canal Commission, Washington, until 10:30 a. m., Aug. 28, for furnishing a steel railroad bridge. Blanks and general information may be obtained at the above office or the offices of the Assistant Purchasing Agents, 24 State St., N. Y. City, and Custom House, New Orleans. La.; also from Chief Quartermaster, Chicago, Ill., and Chief Quartermaster, Atlanta, Ga.

Terre Haute, Ind.—Bids are asked until 11 a. m., Aug. 24, by the Board of County Commissioners, for the construction of the Fletcher Chappel bridge. The bridge to be constructed of concrete, steel reinforced, with 35 ft. span and eliptical arch type. Jerome W. Denehie is County Audr.

Catlettsburg, Ky.—Bids are asked until 2 p. m., Sept. 3, by Maj. J. G. Warren, Corps Engrs., U. S. A., Cincinnati, for constructing service bridge at Lock No. 1, Big Sandy River, Catlettsburg.

Natchez, Miss.—Bids are asked by James S. Fleming, President, until Sept. 3, for the construction of two modern steel bridges, one over Second Creek at the Old Jersey Ford and the other over Meabin's Creek on the Washington and Palestine Road.

Newark, N. J.—Bids, plans and specifications are asked by the Eleventh Ward Bridge Committee until 3 p. m., Aug. 27, at the Essex County Court House, for the construction of a substantial bridge over the Morris Canal on Central Ave. Newark. George F. Deum, County Engineer.

New York, N. Y.—Bids are asked until 2 p. m., Aug. 21, by the Department of Water Supply, Gas and Electricity, John H. O'Brien, Comr., for the construction of piers for two bridges across Watagh Stream.

Ashtabula, O.—Bids are asked by the County Auditor of Ashtabula Countil until Sept. 2, for the construction of a reinforced concrete bridge on the State Road. P. C. Remick, Clerk.

Lebanon, O.—Bids are asked by the County Auditor until Aug. 24 for all labor and material necessary to build the following work: A superstructure over the Little Miami River at Mather's Mill, about two miles south of Oregonia, on the P., C., C. & St. L. R. R., to consist of a two span high truss steel bridge. S. A. Stilwell, County Auditor.

Columbus, O.—Bids are asked until Sept. 4, by the County Commissioners, for bridge work as follows: Engineer's estimate No. 818—Superstructure and roadway construction of the Holt bridge in Franklin Township. No. 819—Concrete encasing of pier of Chenoweth Mill Bridge in Pleasant Township No. 820—Hauling and spreading furnace slag on east approach of Clickenger Bridge in Hamilton Township

Jefferson, O.—Bids are asked until 1 p. m., Sept. 2, by the Board of County Commissioners, for the construction of a reinforced concrete bridge at the State Road. Hartsgrove Township. J. S. Matson is County Surv.

Buildings.

Items Arranged Alphabetically by States.

New Fort Lyon, Colo—Bids are asked by the Bureau of Supplies and Accounts. Navy Department, Washington, D. C., until 10 a. m., Sept. 3, to erect four lean-to wards, etc., at the naval hospital, New Fort Lyon, Las Animas, Colo.

Pensacola, Fla.—Bids are asked until about Oct. 1 for constructing a bank building for American National Bank. Building to be 60x90 ft., ten stories, brick and terra cotta, fireproof construction. Estimated cost, $225,000. Carpenter, Blair & Gould, 475 5th Ave., New York, are Architects.

Athens, O.—Bids are asked until 1 p. m., Aug. 31, by the Athens Masonic Temple Co. for the construction of a 4-story Masonic temple. Plans, etc., at office of secretary and at office of Elmer L. Gerber, Archt., Dayton, Ohio. W. E. Peters, Secy.

BELMONT AVE. SCHOOLHOUSE ADDITION.

Architects, Hurd & Sutton, Union building, 9 Clinton St., Newark, N. J. Consulting Engineer, Percy B. Taylor, 800 Broad St., Newark, N. J.

1. Mason and fireproofing work.
2. Iron work.
3. Carpenter work.
4. Painting work.
5. Plumbing work.
6. Roofing and metal work.
7. Electrical work.
8. Steam heating work
9. Air moving apparatus.

BERGEN ST. SCHOOLHOUSE ADDITION.

Architect, Alfred Peter, 238 Washington St., Newark, N. J. Consulting Engineer, Percy B. Taylor, 800 Broad St., Newark, N. J.

1. Mason and fireproofing work.
2. Iron work.
3. Carpenter work.
4. Painting work.
5. Plumbing work.
6. Roofing and cornice work.
7. Electrical work.
8. Steam heating work.
9. Air moving apparatus.

Contractors may also make a total estimate, combining and including any two or more or all of the several items above mentioned, covering the erection and completion of any one of the said buildings, except for the steam heating work. Proposals for the steam heating and air moving apparatus must be entirely separate and distinct from proposals for any other class of work.

Said proposals must be accompanied by the consent, in writing, of two sureties, who shall, at the time of putting in such proposals, qualify as to their responsibility in the amount of 50 per cent of such proposal and bind themselves that, if the contract be awarded to the person or persons making the proposal, they will, upon its being so awarded, become his or their sureties for the faithful performance of said work; and that if the person or persons omit or refuse to execute such contract they will pay to the said Board of Education of the city of Newark any difference between the sums to which he or they would have been entitled upon completion of the contract and that which the said Board of Education of the city of Newark may be obliged to pay the person or persons by whom such contract shall be executed. The committee will also receive as surety a reliable company duly authorized by the laws of this state to execute such bond as such surety. Work to be completed before Sept. 1, 1908.

R. D. ARGUE, Secretary.

North Chicago, Ill.—Bids are asked at the Bureau of Navigation, Navy Department, Washington, D. C., until 12 o'clock noon, Aug. 26, for furnishing the labor and material necessary to complete the construction of houses for officers' quarters for the naval training station, Great Lakes, North Chicago, Ill. Blank forms of proposals and specifications will be furnished, and plans may be procured upon application to the commandant, naval training station, Great Lakes, North Chicago, Ill. The present condition of the work can also be seen at the naval station named. W. H. Brownson, Chief of bureau.

McAlester, I. T.—The City National Bank, McAlester, I. T., will receive sealed bids for the erection of a bank building in McAlester, I. T., according to plans and specifications furnished by Smith & Parr, architects, until noon, Saturday, Aug. 24. All bids must be accompanied by certified check for 2 per cent of amount of bid. Successful contractor will be required to furnish satisfactory bond for proper performance of contract. Bids will be received for complete building, including heating, plumbing and lighting, and for building separately.

Elkhart, Ind.—Bids are asked by the Library Board at the residence of Mrs. Jacob Sheets until Sept. 2 for the erection and completion of a library building.

Des Moines, Ia.—Bids are asked by the Board of Public Works of this city until Aug. 22, for the construction of a two story brick fire station building on West Eighth St. W. W. Wise, Clerk.

McClelland, Ia.—Bids are asked by J. W. Rounds, Clerk, until Aug. 26, for furnishing the materials and doing the work required to erect a brick jail.

Authon, Ia.—Bids are asked by H. B. Walling, Chairman, Building Committee, until 2 p. m., Sept. 3, for the erection of a parochial school. Bids to contain 2 propositions: First, for the building completed. All materials furnished in accordance with the plans and specifications. Second, for all labor. The committee to furnish the material. Each bid to be accompanied by a certified check for $100.

Cass Lake, Minn.—Bids are asked by J. E. Tapley, President of the Village, until Aug. 21, for the erection and completion of a Village Jail and Fire Hall combined.

Newark, N. J.—Bids are asked for furnishing the material and performing the work required in the erection of the following schoolhouse additions by the Committee on Schoolhouses of the Board of Education of the city of Newark, at a meeting to be held at the city hall, in the rooms of the said board, on Friday, August 23.

The committee will be in session to receive bids from 8:30 o'clock to 8:45 o'clock in the evening. Bids will be opened promptly at 8:45 o'clock.

Proposals properly indorsed must be presented personally and at no other time and place.

Separate proposals may be made on each item as designated under the names of the respective schoolhouses.

Plans and specifications for the proposed school buildings may be examined in the offices of the architects, and the plans and specifications for steam heating work and air moving apparatus for the proposed school buildings may be examined at the offices of the consulting engineers, named in connection with each separate school building noted below:

New York N. Y.—Bids are asked until 10 a. m., Aug. 26, by Arthur J. O'Keeffe, Act. Police Comr., for furnishing all the labor and furnishing and erecting all the materials necessary to build and complete the alterations to the interior arrangement (excepting as to heating and ventilating system, boilers and steam piping) of the new building on the block bounded by Grand, Centre and Broome Sts. and Centre Market Pl., Borough of Manhattan, for headquarters for the police department.

New York, N. Y.—Bids are asked until 10:30 a. m., Aug. 23, by Hugh Bonner, Deputy Fire Comr., for alterations and additions to several volunteer firehouses in Boro. Queens.

New York, N. Y.—Bids are asked by Hugh Bonner, Deputy Fire Comr., until 10:30 a. m., Aug. 28, for furnishing all the labor and materials required for erecting and completing a new building for an engine company to be located on White Plains Ave., south of 230th St. (16th Ave.), in Boro. Bronx, and for furnishing all labor and materials required for a new building for an engine and hook and ladder company at Rockaway Ave. and Ave. F, Boro. Brooklyn.

New York, N. Y.—Bids are asked by J. A. Beusel, Commissioner of Docks, until 12 o'clock noon, Aug. 21, for furnishing all the labor and material required for preparing for and building freight sheds on Piers No. 60, 61 and 62 and on the adjacent bulkhead platforms or lateral extensions between W. 19th and W. 22d Sts. on the North River in the Chelsea section. Time for the completion of the work is within 550 days.

New York, N. Y.—Bids are asked by the President of the Borough of Manhattan, City Hall, New York, until 2 p. m., Aug. 27, for repairs and alterations to the New York County Court House. Time allowed for completing the work is 30 days.

Egeland, N. D.—Bids are asked by the undersigned up to Aug. 31 for the building of a new four room school house at this city. Fred G. Walz, Clerk.

Cleveland, O.—Bids are asked by Charles Orr, City Clerk, until Sept. 9 for furnishing all the materials and doing all the work necessary to complete an annex to the Harvard School.

Hamilton, O.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Sept. 24, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the U. S. Post Office building at Hamilton. Plans and specifications may be had of the Supervising Architect, or of the Custodian of Site at Hamilton.

Mansfield, O.—Bids are asked by W. S. Cappeller of this city until Aug. 31 for the erection of a theater building on Walnut St.

Fort Greble, R. I.—Bids are asked by Willis C. Metcalf, Capt. and Q. M., U. S. A., in charge of construction, 209 Thames St., Newport, R. I., until 10 a. m., Aug. 24, for construction of reinforced concrete coal bin at Fort Greble, R. I.

St. George, S. C.—Bids are asked by the Building Committee until Sept. 3 for the erection and completion of a school building. M. A. Connor, Clerk.

Murfreesboro, Tenn.—Bids are asked by T. E. Hord, Town Clerk, until Aug. 27 for remodeling the present court house at this city.

Price, Utah.—Bids are asked by H. C. Smith, Town Clerk, until Aug. 29, for the erection and completion of the new Carbon County Court House.

Roads and Streets

(Items Arranged Alphabetically by States.)

Montpelier, Ind.—Bids are asked until 8 p. m., Aug. 22, by the City Council, for constructing cement sidewalks.

Sullivan, Ind.—Bids are asked until noon, Sept. 2, by the Comrs. of Sullivan County, for constructing a gravel road in Curry Township, 22,515 ft. in length. E. E. Russel is County Audr.

Fort Wayne, Ind.—Bids are asked by the Board Public Works until 7:30 p. m., Aug. 22, for the construction of the following improvements:

For the construction of cement sidewalks on both sides of Wayne St. from Calhoun St. to Harmer St.

For the construction of cement sidewalks on both sides of Washington blvd. east from Calhoun St. to Barr St.

For the construction of cement sidewalks on both sides of Jefferson St. from Calhoun St. to Barr St.

For the construction of cement sidewalks on both sides of Lewis St. from Calhoun St. to Barr St.

For the construction of cement sidewalks on both sides of Clinton St. from Wayne St. to Lewis St.

Plans and specifications may be seen at the office of the Board Public Works. H. W. Becker, Clerk.

Greencastle, Ind.—Bids are asked by the Board of Commissioners of Putnam County, at the Auditor's office, Greencastle, until 11 a. m., Aug. 31, for the improvement of 5,746 ft. of macadamized road in the township of Jackson. Bids are also asked at the same time and place for the improvement of 9,887 ft. of macadamized road in the township of Warren. Also for the improvement of 3,600 ft. of macadamized road in the township of Jackson. C. C. Hurst, Auditor.

Salem, Ind.—Bids are asked by the Board of Commissioners of Washington County until 1:30 p. m., Sept. 2, for the construction of the Old State Road in Gibson township. The road is about 8,169 ft. in length, and is estimated to cost $2,761. Plans and specifications may be seen at the Auditor's office, Salem.

Indianapolis, Ind.—Bids are asked by the Board of County Commissioners of Sullivan County, Ind., until 12 o'clock noon, Sept. 3, for the construction of 22,515 ft. of gravel road. E. E. Russell, Auditor.

Iowa City, Ia.—Bids are asked by O. J. Slatar, City Clerk, until 2 p. m., Aug. 21, for furnishing material and labor for grading, curbing with combined curbs and gutters of Portland cement concrete and paving with one course of number one, repressed, vitrified brick paving blocks, laid on a 2 inch sand cushion with a proper 5 inch concrete foundation for the following streets, parts of streets and street and alley intersections, to-wit: Bowery St., from the east side of Gilbert St. to the west side of Summit St.; East Burlington St. from the east line of Summit St. to a point 720 feet east of the east line of Summit St.; Van Buren St. from the north side of Market St. to the south side of Bloomington St., all in Iowa City.

The following is an approximate estimate of the work to be done:

4,260 cu. yds. of grading.

7,075 linear ft. of combined curbs and gutters.

11,028 sq. yds. of paving.

Each bidder must accompany his bid with a certified check for $500 on an Iowa City bank made payable to the city treasurer of Iowa City, Iowa, which check must be placed in a sealed envelope separate and apart from the one containing the bid.

St. Paul, Minn.—Bids are asked by the Board of Public Works in and for the corporation of the city of St. Paul, Minnesota, at their office in said city, until 2 p. m. Aug. 22, for the grading of an alley in block 9, Whitney and Smith's addition, in said city, according to plans and specifications on file in the office of said board.

A bond with at least 2 sureties in a sum of at least 20 per cent, or a certified check on a bank of St. Paul in a sum of at least 10 per cent of the gross amount bid, must accompany each bid. Said check shall be made payable to the Clerk of the board.

Union, N. J.—Bids are asked by the Board of Council until 8 p. m., Aug. 26, for the improvement of Broadway from its intersection with Bullsferry Road to the northern boundary line of the town of Union.

(1) By regulating and grading the carriage way and sidewalks to the established grades.

(2) By resetting the present curb, replacing the broken ones with new 4x16 curb, all curb to be set in concrete.

(3) By relaying the present flagging, replacing the broken flag with new flag 2½ in. thick and 4 ft. wide.

(4) By paving the roadway, except that portion occupied by the railroad tracks, with specification trap rock blocks, size 3½ x4½ in. wide, 8x12 in. long and 6x8 in. deep.

(5) By laying cross bridging where necessary.

The plans and specifications for said improvement may be seen at the Town Clerk's office. Emil Bautz, Jr., Town Clerk.

Edgewater, N. J.—Bids are asked by the Council of the Borough of Edgewater until 8 p. m., Aug. 21, for furnishing material and laying a 4 ft. 2 in. blue flag sidewalk on the west side of River Road, from Edgewater Road north to North St., where not already laid.

Work must be done in accordance with specifications now on file in the office of the Borough Clerk. Clarence E. Booth, Borough Clerk.

Mt. Gilead, O.—Bids are asked by W. C. McFarland, Auditor, Morrow County, until 11:30 a. m., Aug. 23, for furnishing all materials and performing all the work or such parts thereof as bidders may see proper for the construction of what is known as the Climax Free Turnpike, beginning at the southwest corner of Section 6, Township 5, Range 17, Canaan township, Morrow County, Ohio, and the line between Marion and Morrow counties, thence easterly to the east line of Canaan township, Morrow County, a distance of 5.17 miles.

Plans and specifications for this work are on file in the office of the Auditor of said county.

Bidders are required to accompany their bids with a certified check of $500 on a bank doing business in Morrow County and made payable to the Commissioners of Morrow County.

Clevelnad, O.—Bids are asked by Julius C. Dour, Clerk Board of County Commissioners, Cuyahoga County, O., until 11 a. m., Sept. 11, for repairing the pavement on the Bentlyville Road in Chagrin Falls township.

Cleveland, O.—Bids are asked by Julius C. Doen, Clerk, Board of County Commissioners, Cuyahoga County, until 11 a. m., Sept. 11, for grading and draining the Taylor Road from a point 800 ft. south of Euclid Ave. to the Mayfield Road, in accordance with plans and specifications to be furnished by A. B. Lea, County Engineer, New Court House, Cleveland. Bids must be accompanied by a check for $1,000 payable to Cuyahoga County.

West Carrollton, O.—Bids are asked by the Council, Elmer Selby, Clerk, until 12 o'clock noon, Aug. 24, for furnishing the necessary labor and materials for the following improvements:

First, for grading and graveling the roadway of Poplar St. from Pease Ave. to the north corporation line, in said village.

Second, for grading and graveling roadway of Smith St., from Main St. to north corporation line, in said village.

Third, for grading and graveling the roadway of Walnut St., from Main St. to north corporation line, in said village.

Fourth, for grading and graveling the roadway of Burns St., from Pease Ave. to north corporation line, in said village.

Fifth, for grading and graveling the roadway of Elm St., from Pease Ave. to north corporation line, in said village, according to plans and specifications on file in the office of the Clerk of said village. Bidders must bid separately on each of the four mentioned improvements.

Ridgway, Pa.—Bids are asked by George F. Greiner, Borough Clerk, until 12 o'clock noon, Aug. 31, for the grading, paving, setting of curb and improvement of West Main St. The work comprises about 2,000 cu. yds. excavation and 8,100 sq. yds. brick paving with concrete base and 6,200 lin. ft. curb setting, also 700 cu. yds. masonry, 575 cu. yds. concrete foundations and 550 cu. yds. foundation excavation.

Milwaukee, Wis.—Bids are asked by the Commissioners of Public Works until 10:30 a. m., Aug. 23, for laying an asphalt pavement having a concrete foundation, and curbing the sidewalks with stone, on Broadway from Oneida St. to the south line of Johnson St. A check for $3,000 must accompany each bid.

Milwaukee, Wis.—Bids are asked by Board of Public Works until 10:30 a. m., Aug. 23, for doing the work of paving the roadway with a permanent bitulithic pavement having a concrete foundation and curbing the sidewalks with stone (old curbing to be reset), on the following named streets in the city of Milwaukee, according to the respective specifications on file in this office.

EIGHTEENTH WARD.

Lake Drive, from Kenwood Blvd. to a point 210 ft. north of Hartford Ave.

Work to be completed within 60 days from the date of the award of the contract.

TWENTIETH WARD.

Teutonia Ave., from the center of Wright St. to the north line of Hadley St.

Work to be completed within 80 days from the date of the award of the contract.

Bidders must submit proposals for each street separately and shall state therein prices respectively per square yard for the paving, including all the necessary grading, per lineal foot for new curbing and per lineal foot for resetting old curbing.

Sewers.

Items Arranged Alphabetically by States.

Auburn, Ind.—Bids are asked by the Common Council until 7:30 p. m., Aug. 21, for the following public improvements: Construction of a local sewer in Cedar St. and 14th St., to be built of 15-in. vitrified pipe. Beginning at the intersection of 10th and Cedar Sts. in the Original Plat of the city of Auburn, and running thence south on Cedar St. to the intersection of 14th St. and Cedar St., thence east on 14th St. to the terminus of said street, thence easterly, ending in Cedar Creek ditch. The detailed plans, profiles, drawings and specifications are on file and may be seen in the office of the City Engineer. Bidders must accompany each bid with a certified check in the sum of not less than $50. E. O. Little, City Clerk.

Bloomfield, Ind.—Bids are asked by Chas. E. Cumbs, Pres. Board of Trustees, until 2 p. m., Aug. 26, for the pipe branches, junctions, manholes and materials of all kinds, f. o. b. cars Bloomfield, Ind., or delivered on the ground, and for the construction complete, with or without materials, or any part of the same separate, of main and minor sewers in system of sewerage, to and including outlet in river, all in the town of Bloomfield, Ind., as per map, plans, profiles and specifications therefor, now on file in the office of the town clerk, in Bloomfield, and in the office of the engineer, George Cadogan Morgan, 169 Jackson Blvd., Chicago.

All proposals must be accompanied by a certified check for 10 per cent of the amount of bid, made payable to the Treasurer of said town.

Des Moines, Ia.—Bids are asked by the Board of Public Works, until 11 a. m., Aug. 23, for constructing sewers, approximate quantities as follows: 15,311 lin. ft. of 10-in. sewer, 455 lin. ft. of 12-in. sewer, 583 lin. ft. of 15-in. sewer. W. W. Wise and W. F. Harsh, Bd. Pub. Wks.

Manchester, Ia.—Bids are asked by the City Council until 12 o'clock noon, Aug. 26, for the construction of a sewer, commencing at a point on the main sewer extending from Franklin St. directly west of the center of the alley and extending eastward along the center of the alley between Marion and Jasper Sts. to the center of Wayne St., and thence north along the center of Wayne St. to the center of the alley between Main and Delaware Sts., and thence west along said alley to Brewer St., and continuing north along the center of Wayne St. from the point where said Wayne St. is intersected by the alley between Main and Delaware Sts. to the center of the alley between Main and Fayette Sts. and thence east along the center of said alley to a point at or near Potter St., in accordance with the plans of the Grade Book of Streets and Sewers and the Map of the Sanitary Sewer System of Manchester, and the specifications for such construction now on file in the office of the City Clerk.

This sewer is to be constructed of first class standard vitrified tile, with all joints sealed and all manholes, flush tank and connections placed, located and constructed in a good workmanlike manner.

The work of constructing this sewer, including the replacing of materials removed, shall be completed on or before the 1st day of December, 1907. Edw. H. Ruby, City Clerk.

Ann Arbor, Mich.—Bids are asked by Ross Granger, City Clerk, until 7:30 p. m., Aug. 21, for the construction of lateral sewer No. 28, Belmont, Volland and Observatory Sts. Plans and specifications may be seen at the City Engineer's office. Certified check for $200 must accompany each bid.

St. Paul, Minn.—Bids are asked by R. L. Gorman, Clerk, Board of Public Works in and for the corporation of the city of St. Paul, at their office in this city, until 2 p. m., Aug. 22, for the construction of a sewer on Reaney St., from Duluth Ave. to Atlantic St.; on Atlantic St., from Reaney St. to Beech St., and on Beech St., from

Atlantic St. to Duluth Ave., according to plans and specifications on file in the office of the board.

A bond with at least two sureties. in a sum of at least 20 per cent, or a certified check on a bank of St. Paul in a sum of at least 10 per cent of the gross amount bid, must accompany each bid. Check shall be made payable to the Clerk of the board.

Also bids are asked at same time and place for the construction of a sewer on the north side of University Ave., from Snelling Ave. to Pascal Ave., and for the construction of a sewer on Jessamine St., from Park Ave. to Sylvan St. Plans and specifications as above.

New Ulm, Minn.—Bids are asked until 5 p. m., Sept. 3, by the City Clerk, for constructing a concrete sewer on Franklin St. Ernst Wicherski is City Clk.

Columbus, O.—Bids are asked by the Bd. of Pub. Wks., until Sept. 2, for constructing sewers in 5th and Mechanics Sts.

Cleveland, O.—Bids are asked until noon, Aug. 27, by the Board of Public Service, for constructing sewers as follows: Massie Ave., between E. 105th St. and Parkwood Drive; extension of the portion of the intercepting sewer system between E. 105th St. and a point 1,750 ft. east. W. J. Springborn is Pres. Bd. of Pub. Serv.

Oakley, O.—Bids are asked by the Clerk of the village of Oakley, Hamilton County, O., until 12 o'clock noon, Aug. 27, for furnishing the necessary labor and materials for constructing sewers in District No. 2 (including the following streets: Linden Ave., Brotherton St., Sherman Ave., Elder Ave. and the outlets), in accordance with the plans, specifications and estimates on file in office of the Clerk.

Each bid must be accompanied by a bond in the sum of $500 to the satisfaction of the board, or a certified check on some solvent bank.

Bidders are required to use the printed forms, which will be furnished upon application to Walter E. Sullivan, Village Engineer, Room 907, Commercial-Tribune building, Cincinnati, O. David K. Mason, Clerk.

Warren, O.—Bids are asked until noon, Aug. 26, by the Board of Public Service, for constructing a sewer in Youngstown Ave. H. H. Pierce is Pres. Bd. Pub. Wks.

Monessen, Pa.—Bids are asked by the Borough Engineer until 4 p. m., Sept. 5. for the construction of a storm water sewer and appurtenances, as follows: 700 lin. ft. of 4'-6"x6'-9" oval shaped 3 rung brick, as per plans and specifications on file in the office of J. F. Irwin, Borough Engineer. Advertisement appears elsewhere in ENGINEERING-CONTRACTING.

Beaver Dam, Wis.—Bids are asked by the Board of Public Works for the construction of 4,438 ft. of pipe sewer, together with manholes and about 114 ft. of cast iron pipe sewer, on Aug. 24, at 2 p. m.

Specifications are on file in the office of the undersigned, where the same can be examined. Anton A. Fischer, Clerk, Beaver Dam, Wis.

Lake Mills, Wis.—Bids are asked by N. H. Falk, City Clk., until 7:30 p. m., Sept. 13, for the construction of approximately 1,887 ft. of 6-in., 1,887 ft. of 8-in., 1,225 ft. of 10-in., 823 ft. of 12-in., 1,513 ft. of 15-in., 75 ft. of 18-in. and 2,367 ft. of 24-in. vitrified pipe sewers, 26 manholes and 10 catchbasins. Each bid must be accompanied by a certified check for $500. Plans and specifications will be on file after Aug. 24, at the City Hall, Lake Mills, and at 31 Vroman Building, Madison, Wis. N. H. Falk is City Clk. W. G. Kirchoffer is Engineer.

Water Supply

Items Arranged Alphabetically by States.

Pensacola, Fla.—Bids are asked by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a. m., Sept. 7, for constructing water works, including 100,000-gal. steel tank, at the Navy Yard, Pensacola.

Chicago, Ill.—Bids are asked by the Board of Local Improvements until 10:15 a. m., Aug. 27, for the construction of the following improvements:

(1) Warrant 35250—Water service pipes in Glenlake Ave., from Southport Ave. to Evanston Ave.

(2) Warrant 35251—Water service pipes in Southport Ave., from Bryn Mawr Ave. to Balmoral Ave.

According to plans and specifications for each of said improvements on file in the office of the Board of Local Improvements. H. S. Dietrich, President Board of Local Improvements.

Du Quoin, Ill.—Bids are asked until 8 p. m., Aug. 23, for constructing a system of water mains. Plans and specifications are on file at the office of the City Clerk, Du Quoin, and at the office of Geo. Cadogan Morgan, Engineer, 808 Royal Ins. Bldg., Chicago.

Montgomery, Minn.—Bids are asked by the Common Council until 7:30 p. m., Aug. 31, for laying 524 ft. of 6-in. water main, hydrants, etc. A. S. Olson, City Recorder.

Pleasantville, N. Y.—Bids are asked by the Board of Water Commissioners until 7:30 p. m., Aug. 26, for constructing a storage reservoir, with an earth dam, spillway, masonry core wall, gate house and pipe conduit.

Norfolk, Va.—Bids are asked by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a. m., Sept. 14, for constructing a steel tank and tower, Navy Yard, Norfolk, Va.

Excavation—Earth and Rock

Items Arranged Alphabetically by States.

Little Rock, Ark.—Dredging and Concrete Conduit.—Bids are asked until 10 a. m., Sept. 7, for the construction of seven miles open ditch, requiring 143,000 cu. yds. of earth excavation, one reinforced concrete conduit, 84 ins. in diameter, 2,635 ft. long. Estimated cost $76,500. Lund & Hill, Engineers. Joe Asher, County Clk.

New London, Conn.—Dredging.—Bids are asked by Maj. Harry Taylor, Corps Engrs., U. S. A., until noon, Sept. 7, for dredging in Stamford Harbor, Conn.

Washington, D. C.—Dredging.—Bids are asked until 11 a. m., Sept. 7, by R. C. Hollyday, Ch. Bureau Yards and Docks, Navy Yard, for dredging and removing about 20,000 cu. yds. of material from channel, navy yard, Washington.

Woonsocket, S. D.—Drainage Ditch.—Bids are asked by the County Commissioners of Sanborn County until 1 p. m., Sept. 4, for the construction of drainage ditch No. 3.

Said ditch is estimated at 146,000 cu. yds. of wet construction; ditch 12 ft. wide at bottom, and average depth 9 ft. Specifications are on file with County Auditor. All bids must be accompanied by certified check for $1,000.

Address County Auditor, Lewis Strand, Woonsocket, S. D.

Joliet, Ill.—Excavation and Concrete Wall.—Bids are asked by the Spring Creek Drainage District Commissioners, until 2 p. m., Sept. 3, for excavation of channels and for building concrete walls. Estimated quantity: Excavated material, 90,000 cu. yds.; concrete walls, 10,000 cu. yds.

Decatur, Ind.—Ditch Work.—Bids are asked until 10:30 a. m., Aug. 24, by the Supt. of Cons. of Adams Co., for the construction of the Studier ditch in Hartford Township.

New Orleans, La.—Dredging.—Bids are asked by Capt. J. F. McIndoe, Corps Engrs., U. S. A., until 11 a. m., Sept. 10, for dredging in Southwest Pass, Mississippi River.

Boston, Mass.—Dredging. Bids are asked until 2 p. m., Aug. 23, by the Board of Harbor and Land Commissioners, Boston, for dredging shoals in Ipswich River, in town of Ipswich. Frank W. Hodgdon, Ch. Engr.

Miscellaneous

Items Arranged Alphabetically by States.

Idaho Springs, Colo.—Dam. Bids are asked by the City Clerk until 8 p. m., Aug. 21, for the furnishing of all materials and the construction of a rock and earth-filled dam across the south fork of Chicago Creek at a point about three and three-quarter miles from the forks of Chicago Creek and about ten miles from Idaho Springs, and a road thereto of about two and one-half miles from the forks of the creek.

Plans and specifications can be seen at the City Clerk's office on and after Aug. 12. Chas. Brandstetter, City Clerk.

Joliet, Ill.—Channels and Concrete Walls.—Bids are asked by the Spring Creek Drainage District Commissioners, 221 Barber Bldg., Joliet, until 3 p. m., Sept. 3, for excavating channels and constructing concrete walls. The work comprises about 90,000 cu. yds. excavation and 10,000 cu. yds. concrete walls.

Rushville, Ind.—Crushed Stone and Gravel.—Bids are asked until 2 p. m., Aug. 31, by the Free Turn Pipe Dircts. of Rush Co., for furnishing crushed stone and gravel for several roads in this county.

Bar Harbor, Me.—Breakwater.—Bids are asked by Maj. George A. Zinn, Corps Engrs., U. S. A., Portland, until noon, Sept. 10, for construction of a breakwater at near Bar Harbor.

Baltimore, Md.—Disposition of Garbage.—Bids are asked until 11 a. m., Sept. 4, by the Board of Awards, J. Barry Mahool, Pres., for removal and final disposition of garbage, dead animals and market refuse, from Jan. 1, 1908, until Jan. 1, 1918. J. L. Wickes is Comr. of Street Cleaning.

New York, N. Y.—Iron Flagstaff.—Bids are asked until 10:30 a. m., Aug. 30, by G. C. Burnell, Cont. Q. M., Fort Wood, N. Y. H., for foundation, painting and erecting of a 100-ft. iron flagstaff at this post.

New York, N. Y.—Rubble Stone, Dikes.—Bids are asked by Col. John G. D. Knight, Corps. Engrs., U. S. A., until noon, Sept. 2, for furnishing rubble stone and quarry spalls for constructing and repairing dikes in Hudson River, N. Y.

Cincinnati, O.—Dike and Dam.—Bids are asked by Wm. L. Rossell, Lieut. Col., Engineers, U. S. Engineer Office, Cincinnati, until 2 p. m., Sept. 11, for constructing concrete dams, etc., at head of Brown's Island and head of Marietta Island, Ohio River, and for building a dike and shore protection in Ohio River near head of Grand Chain, Ill.

Materials, Machines, Supplies, Tools, Etc

(Items Arranged Alphabetically by States.)

Chicago, Ill.—Iron and Steel Poles.—Bids are asked by the City Electrician at his office, room 12, City Hall, Chicago, until 11 a. m., Aug. 23, for furnishing the department of electricity, city of Chicago, with material and supplies in approximately the following amounts, strictly in accordance with specifications and blue prints on file in the office of said official:

150 or more combination cast iron and steel electric light arc lamp posts.

2,000 25-ft. tubular steel poles, 3 in.x4 in.

2,000 ornamental cast iron bases for tubular steel poles.

2,000 iron pole tops to slip inside poles.

2,000 cast iron collars for steel poles, 4 in.

A separate set of specifications will be drawn up covering the above items, as follows: The arc lamp posts, the tubular steel poles, and the cast iron bases, pole tops and collars, thereby necessitating a separate proposal blank for each item. Proposals must be made out upon blanks furnished by said official, inclosed in sealed envelope, be addressed to "City Electrician, Room 12, City Hall, Chicago, Illinois," and be indorsed "Proposals for Electric Light Arc Lamp Posts," "Proposals for Tubular Steel Poles," or "Proposals for Cast Iron Bases, Pole Tops and Collars," as the case may be,

Each proposal for the same must be accompanied with 5 per cent of the amount of such proposal in money or certified check on some responsible bank doing business in the city of Chicago, which check must be made payable to the City Electrician. WILLIAM CARROLL, City Electrician.

Chicago, Ill.—Iron Fence and Gates.—Bids are asked by the South Park Commissioners at their office, 57th St. and Cottage Grove Ave., until 12 o'clock noon, Aug. 21, for the furnishing and delivery, within the south park system, of iron gates and approximately 550 ft. of iron fence. Specifications and other information may be obtained at the above named office. Proposals must be accompanied by certified check, payable to the South Park Commissioners, or currency in the sum of $100. E. G. Shumway, Secretary.

New York, N. Y.—Machine Tools.—Bids are asked by J. A. Bensel, Commissioner of Docks, until 12 o'clock noon, Aug. 27, for furnishing all the labor and materials required for furnishing and delivering miscellaneous machine tools. Time allowed for completion of work, 180 days.

New York N. Y.—Sand and Broken Stone.—Bids are asked by J. A. Bensel, Commissioner of Docks, until 12 o'clock noon, Aug. 27, for furnishing all the labor and materials required for furnishing and delivering sand and broken stone. Time allowed for completion of work 180 days. The amounts wanted are about 3,000 cu. yds. of sand and 7,500 cu. yds. of broken stone.

New York, N. Y.—Cleaning System.—Bids are asked by Henry S. Thompson, Commissioner Public Works, until 2 p. m., Aug. 26, for the construction and installation of a suction or vacuum cleaning system in the Criminal Courts Building.

River Falls, Wis.—Fire Hose.—Bids are asked by the City Council of this city until Sept. 5 for the furnishing to said city of from 500 to 1,000 ft. of 2½-in. rubber-lined cotton-covered fire hose for its fire department. Allen P. Weld, City Clerk.

CONTRACTS LET,

Items Arranged Alphabetically by States.

Belleville, Ill.—Reeb Bros., Belleville, have been awarded the contract at $13,940 for paving 5 streets. The Hoeffken Bros., Belleville, were awarded contracts for paving and sewering 2 streets, their bids amounting to $73,882, and the McIntyre & Tesse Construction Co., St. Louis, Mo., were awarded the contract at $16,695 for constructing the Tower Grove sewer.

Carthage, Ill.—Electric Railroad.—The Federal Construction Co., 15 Broadway, New York City, have been awarded the contract for building an electric line from Carthage to Nauvoo, Ill.

Freeport, Ill.—Brick Paving.—William Archer has been awarded the contract at $48,200, for paving portions of Walnut, Ringold, Pleasant and Empire Sts. and Galena Ave. with Purington brick.

Moline, Ill.—Street Work.—The Moline Heating and Construction Co. have been awarded the contract at $2,487, for putting in a water main along 15th St., from 25th Ave. south to the city limits, and water main and sewer along 11½ St., between 12th and 16th Aves., price being $952.

Moline, Ill.—Paving.—The Tri-City Construction Co. have been awarded the contract at $7,299, for paving 13th St. with brick, between 12th and 16th Aves.

Pearl City, Ill.—Macadamizing. — John Morrow, Freeport, Ill., has been awarded the contract to macadamize the highway south of the corporation; macadamizing to be a rod wide and composed of 8-ins. of rock and 4 ins. of gravel on top. The price is $9 per sq. rod.

Princeton, Ill.—Bridges. — The Joliet Bridge and Iron Co. have been awarded the contract for 3 bridges, to be built across the Esernaba River at Princeton. The bridges are to be of steel, with sidewalks, and each will have a span of 50 ft.

Pekin, Ill.—Bridge.—The Schmidt Construction Co. have been awarded the contract at $2,158, for the construction of a steel bridge, with concrete piers, over the Big Mackinaw River in Hopedale Township.

Sterling, Ill.—Bridges. — The Clinton Bridge & Iron Works were awarded the contract for the erection of 3 bridges in Clyde Township. Their bid was $2,400.

Pekin, Ill.—Bridge.—The Tremont Bridge Co. has been awarded the contract at $2,975, to replace the old Bequeath bridge south of Pekin.

Waukegan, Ill.—Sewer—Bids were received July 19 by M. R. Miller, Superintendent of Public Works, for constructing North Side sewer, the contract being awarded to D. West & Co., 69 Loan & Trust Bldg., Milwaukee, Wis., at the following bid:

Item.	Quantity.	Cut.	
	Lin. Ft.		
48-in. reinforced concrete.	200	4	$11.76
48-in concrete	2,400	3	4.88
36-in. concrete	1,300	10.6	3.95
30-in. concrete	830	11.2	3.80
27-in. concrete	2,330	16.3	3.45
24-in. concrete	594	11.7	3.00
21-in. vitrified pipe	1,375	12.7	2.18
18-in. vitrified pipe	1,230	10	1.85
15-in. vitrified pipe	2,740	11.2	1.78
12-in. vitrified pipe	2,285	10.8	1.65
9-in. vitrified pipe	3,380	9.8	1.42
6-in. vitrified pipe risers	1,500	...	0.28
20-in. cast iron pipe	200	...	5.33
Manholes	62	...	40.00
Catch basin	1	...	35.00
Lamp holes	1	...	10.00
Flushing devices	15	...	20.00
	Cu. Yds.		
Concrete masonry	200	...	9.00
Brick masonry	1	...	17.00
	B. Ft.		
Lumber	1,000	...	30.00
	Cu. Yd.		
Excavation	1	...	1.00
Bulkheads	1	...	175.00
	Lin. Ft.		
Piles	800	...	0.42
Total bid			$58,088.55

Columbia City, Ind.—Sewer.—Kessler & Briggs have been awarded the contract at $2,357, for the extension of the city sewer system into the Brownwood addition.

Indianapolis, Ind.—Sewer.—Morris M. Defrees has been awarded the contract for constructing the Kentucky Ave. sewer west of White river. The engineer's estimate of the cost is $60,000.

Greencastle, Ind.—Road Construction.—Mahoney & Allen, Greencastle, Ind., have been awarded the contract at $17,300, for the construction of road, macadamizing, etc., on the John Metter et al. highway.

Terre Haute, Ind. — Paving. — The Foulkes-Forbes Co. have been awarded the contract for the paving of 5th Ave., from 13th to 19th Sts.

South Bend, Ind.—Street Work.—Contracts for street improvements were awarded as follows: For the grading and laying cement curbs and walks on Georgiana St., to T. C. Barnes; same improvement on Carlisle St., Dunham St., Olive St., Ford St. and Warren St., to T. M. Bauer; same improvements on Rupel St., Grant St., Pine St. and Phillipa St., to J. A. Barnes; on Johnson St. and Linden Ave., to C. L. Headley, and on High St., to John Baer. The contract for grading the alley north of La Salle Ave. was awarded to Shipe & Turner, and for laying cement curbing on Adams St. to George Headley.

Shelbyville, Ind.—Bridge.—Avery, Hammond & Howard, Waldron, Ind., have been awarded the contract at $4,157, for the construction of a reinforced concrete arch over Little Sugar Creek.

Auburn, Ind.—Paving.—The Western Construction Co. have been awarded the contract for two miles of asphalt paving on five of the principal streets of Auburn.

Bluffton, Ind.—Bridges.—Naaman, Miller & Son, Bluffton, Ind., have been awarded the contract at $5,627, for the construction of 8 of the 9 bridges in Wells County and Solomon Carter, Marion, Ind., was awarded the contract at $2,150, for the construction of the remaining bridge.

Bartlesville, Ind. T.—Steel Bridges.—The Southwestern Bridge Co., Joplin, Mo., has been awarded the contract for steel buildings for machine shop and foundry of the Bartlesville Foundry & Machine Works.

Webster City, Ia.—Sewer.—Sullivan & O'Connor, Webster City, Ia., have been awarded the contract at $31,598, for the construction of over three miles of sewer in this city.

Mott, Ia.—Bridge.—The Fargo Bridge & Iron Co., Fargo, N. Dak., have been awarded the contract at $3,490, for the building of a steel bridge across the Cannon Ball River at Mott.

New Hampton, Ia.—Power Plant.—Shepard & Hutton have been awarded the contract at $8,611, for constructing the power plant at this place.

El Dorado, Kan.—Sewers.—E. M. Eby, Coffeyville, Kan., was awarded the contract at $7,496, for building the sewers in the new territory.

Wichita, Kan.—Sewer. — McIntyre & Pease have been awarded the contract at $71,978, for the building of the West Side sewer.

London, Ky.—Waterworks System. — Alex. T. Wilson, Barboursville, Ky., has been awarded the contract to drill wells in East London to supply a system of waterworks for the entire town.

Frederick, Md.—Bridge.—The York Bridge Co., York, Pa., has been awarded the contract at $1,795 to erect an iron bridge over Owen's Creek, near Longs Mill, Md. The bridge will be 83 ft. long and 14 feet wide. John A. Cookerly, Middletown, Md., was awarded the contract for the mason work.

Grand Rapids, Mich.—Sewers.—Richard Pickett has been awarded the contract at $5,987 for the building of the Ashland Ave. sewer, and James B. Hoey was awarded the contract at $2,100 for the Hovey St. sewer.

Lansing, Mich.—Electric Railway.—W. E. Tench & Co., Detroit, Mich., have been

Solving Sewer Problems

In any sewer system, large or small, obstructions and stoppages are bound to occur. A comparatively small obstruction may cause an aggravating amount of work and unnecessary expense, simply because one is without the proper tools to get right at the trouble at once.

Sewer superintendents all over this country are solving this problem and demonstrating to their perfect satisfaction that they can by the use of

FELTON IMPROVED COUPLINGS

the best and most appropriate couplings for connecting sewer rods, ever put on the market, quickly remove all ordinary obstructions, and very much simplify maintenance and cleaning sewer systems.

In connection with the couplings we manufacture a line of sewer cleaning tools. Every tool is made for a particular use, and, together with the couplings, make the most complete sewer cleaning outfit which it is possible to obtain. If you would like to see the tools and get all the information—send for our little booklet. It will prove highly interesting.

HAROLD L. BOND COMPANY,
146 Pearl Street LONG DISTANCE TELEPHONE BOSTON, MASS.

awarded the contract for the construction of 40 miles of electric railway for the Lansing-Jackson interurban line.

Eaton Rapids, Mich.—Paving.—Farrel Bros. & Algate, Lansing, Mich., have been awarded the contract at $23,643.63 for paving Main St. from bridge to bridge. Metropolitan brick is to be used on a concrete foundation and pitch filler combined curb and gutter.

Pontiac, Mich.—Paving.—Lennane Bros., Detroit, Mich., have been awarded the contract for paving Asylum and Ashland Aves. Logan brick with pitch filler is to be used.

Hastings, Minn.—The Des Moines Bridge & Iron Works have been awarded the contract at $69,475 for the system of waterworks and sewers in Hastings. The operators will begin on or before Nov. 1st, and the contract is to be completed by July 1, 1898.

Omaha, Neb.—Railway Terminal.—The Blanchard Contracting Co., No. Topeka, Kans., has been awarded the contract for building the new terminal of the Missouri Pacific system. The estimated cost is over $45,000.

Kansas City, Mo.—Grading and Macadamizing.—J. Ray Samuel has been awarded the contract at $800 for grading and macadamizing 75th St. from Troost Ave. to Wornall road. The paving is to cost $1.75 a cubic foot and the excavating will be done at a cost of 25 cents a cubic foot.

St. Joseph, Mo.—Sewers.—The J. H. Hartman Bridge & Construction Co. was awarded the contract at $4,420 for the extension of the Wyatt Park sewer. The same company was also awarded the contract at $1,302 to extend the main sewer in Missouri Ave. from Williams to Barbara St. Rockliffe & Gibson were awarded the contract at $5,033 to extend the main sewer in King Hill Ave. from Cherokee to Osio St. G. O. Shilbred was awarded the contract at $1,058 to construct inlets, catchbasins and manholes for the So. St. Joseph main sewers.

Helena, Mont.—Railway Construction.—Shepherd, Sims & Co. have been awarded the contract by the Northern Pacific Ry. Co. to build the Elliston cut-off, which will bring Elliston ten miles nearer Helena. There will be a tunnel on the new line 300 feet long.

Lowville, N. Y.—Water Supply.—John Siegrist, Utica, N. Y., has been awarded the contract for the construction of the water system of the Martinsburg water district.

Rochester, N. Y.—Paving.—F. C. Lauer & Son's Co. have been awarded the contract at $31,770 for paving Driving Park Ave. from Dewey Ave. to the city line. Shawmut brick will be used.

Rochester, N. Y.—Bridge.—Whitmore, Ranber & Vicinus were awarded the contract at $1,923 for building a concrete bridge in Falls St.

Asheville, N. C.—Sewer.—J. R. Rich has been awarded the contract at $1,946 for building the sewer main on Pearson drive.

Bucyrus, O.—Sewage Disposal Plant.—Bids for sewage disposal plant at the Crawford County Infirmary, Bucyrus, were opened July 19 and contract awarded to Martin Tiner and John Portman, Bucyrus, at the following figures: Excavation 40c per cu. yd.; brick masonry $20 per cu. yd.; concrete masonry $7 per cu. yd.; steel 6c per lb.; lumber in place, $40 per M. ft.; screen $6; 8-in. cast iron sluice gates, $8 each; cast iron wire $1; 3-in. automatic siphon $4; vitrified sewer pipe, 75 per cent off list; laying 20-in. sewer pipe 8c per ft.; laying 8-in. sewer pipe 6c per ft.; laying underdrains 6c per ft.; lake sand for filters $2.25 per cu. yd.; sodding 10c per sq. yd.; manhole tops $15 each; crushed stone in filters $2 per cu. yd.; total amount of bid, $1,959.79. E. G. Bradbury and George P. Shute, Engineers, 85 North High St., Columbus, O.

Columbiana, O.—Paving.—George D. Smith & Bro., Salem, O., were awarded the contract for paving Main St. from Spring Alley to the Ft. Wayne Railroad. The distance is over 2,200 feet and the width of the pavement will be 40 feet.

Cleveland, O.—Structural Steel.—The American Bridge Co. has been awarded the contract at $150,000 for the structural steel to be used in the building of the new mill of the American Steel & Wire Co., along the Newburgh & South Shore railroad. The steel covered by this contract amounts to 2,100 tons.

Dayton, O.—Storm Sewer.—Paul & Kershner have been awarded the contract at $21,456 for constructing and intercepting storm sewer in Riverdale.

Dayton, O.—Street Work.—William J. Kernan was awarded the contract for paving alley east of Bank St. to Fourth St from Fourth St. to the first alley north of Fifth St., cement, $1,246. Hecker & Kirchner, improving Laymon Ave. from Huffman Ave. to Davis St., $1,535; Frank Munger, improving Summit St., to the first alley west of Benton St., $1,178; Hecker & Kirchner, improving Magley St., from Burkhardt to Fifth St., $1,485; C. F. Sullivan, construction of Edgar Ave. storm sewer, $1,484; William J. Kernan, paving alley west of Perry St., from Third to

STORM WATER SEWER.

Monessen, Pa., August 15, 1907.

Sealed proposals will be received at the office of the Borough Engineer until 1 o'clock p. m., Thursday, September 5th, for the construction of a storm water sewer and appurtenances as follows: 700 lin. feet of 4 foot 6 inch by 6 foot 9 inch oval shaped 3-ring brick, as per plans and specifications on file in the office of the Borough Engineer.

J. F. IRWIN,
Borough Engineer.
W. A. MILLER,
8-2t Chairman St. and Roads Com.

STORM WATER SEWERS.

Omaha, Neb., July 29, 1907.

Sealed proposals will be received at the office of the City Engineer up to 2 o'clock p. m., Monday, August 26th, for the construction of storm water sewers and appurtenances as per plans and specifications on file in the office of the City Engineer.

The work to be done embraces approximately as follows:

840 feet sewer, 10 feet in diameter.

860 feet sewer, 11 feet 3 inches in diameter.

1,440 feet sewer, 12 feet in diameter.

250 feet, more or less, of 16 by 7½ reinforced concrete construction.

80 feet sewer 42 inches in diameter.

1,600 feet sewer, 30 inches in diameter.

150 feet open ditch work.

Payment for said work to be made upon a cash basis; 90 per cent on monthly estimates; an additional 5 per cent when work is accepted, and 5 per cent in one year after the completion of the work. Each bid shall be accompanied with a certified check in the sum of $3,000.00 as guarantee of good faith that the bidder will promptly enter into contract if award shall be made to him. The city reserves the right to reject any or all bids.

ANDREW ROSEWATER,
5-4t City Engineer.

INTERNAL IMPROVEMENT COMMISSION OF THE STATE OF ILLINOIS.

NOTICE TO BIDDERS.

Sealed proposals addressed to the "Internal Improvement Commission of the State of Illinois" and endorsed

"PROPOSAL FOR ALL OF THE WORK OF REINFORCING THE SHAWNEETOWN LEVEE"

will be received by the Engineer of the Commission at the office of the Mayor of Shawneetown, Ill., up to 12 o'clock noon (standard time) of Thursday, the 22d day of August, 1907, and thereafter the said bids will be opened by the Chairman of the said Commission and awarded to the lowest responsible bidder; or all bids may be rejected as he may decide best.

The work to be covered by said bids is borrowing, transporting and placing clay or other suitable material for levee building; all as set forth in the specifications under which the work will be done. The total amount of filling approximates fifty thousand cubic yards. Probably half of this amount can be most cheaply done by wagons; the other half is properly car work.

There is now available for this work sufficient railroad iron for any tracks needed.

Maps and specifications can be seen in the office of the Engineer in Shawneetown and in the office of the Chairman, 18th floor of the American Trust Building, Chicago. Bidders must before bidding personally examine the ground.

No bid will be accepted until the bidder has made proof satisfactory to the Chairman of his experience in such work and his ability to carry out the contract.

The Chairman reserves the right to reject any and all bids.

THE INTERNAL IMPROVEMENT COMMISSION OF ILLINOIS.
ISHAM RANDOLPH,
7-2t Chairman.

HIGHWAY IMPROVEMENT.

Bergholz, Ohio.

Sealed proposals will be received at the office of the Trustees of Springfield Township, Jefferson County, Ohio, until 3 p. m., Thursday, September 5, 1907, for the grading and macadamizing of five (5) miles of road in Springfield Township, between Bergholz and East Springfield. Specifications can be obtained from W. A. Taylor, Clerk, Bergholz, Ohio; R. H. Lee, Engineer, Carrollton, Ohio, or John A. Huston, Attorney, Steubenville, Ohio.

The right is reserved to reject any or all bids.

By order of the Township Trustees.

W. A. TAYLOR,
8-1t Township Clerk.

Mead St., with cement, $2,046; William Hilt, construction of Rubicon creek storm sewer, $15,945; Paul & Kershner, construction of Huston Ave. storm sewer, $1,223; C. F. Sullivan, construction of the Western Ave. storm sewer, $654; Paul & Kershner, construction of the Kilmer St. storm sewer, $587.

Massillon, O.—Bridge.—E. J. Lander, Canton, has been awarded the contract at $24,000 for constructing the West Tremont St. bridge over the Tuscarawas River. The bridge will be built of concrete.

Mendon, O.—The Bluffton Stone Co. has been awarded the contract at $17,500 for macadamizing Main St.

Painesville, O.—Bridge Abutments.—W. J. Torrington, New Castle, O., has been awarded the contract at $40,000 for the construction of new bridges on the Baltimore & Ohio. The structures will be of concrete and will be substantially constructed.

Sayre, Okla.—Tank and Tower.—The Southwestern Bridge Co., Joplin, Mo., have been awarded the contract for a 50,000-gallon tank and tower.

Seven Mile, O.—Bridge Superstructure.—The Oregonia Bridge Co., Lebanon, O., was awarded the contract at $1,623 for the construction of a new superstructure and the laying of concrete floor for the bridge over Nine Mile creek.

Steubenville, O.—Paving.—H. M. Bates has been awarded the contract at 69¾ cents for hillside block, 53 cents for new sandstone curbing and 23 cents for re-setting old curb for paving Washington St.

Miner's Mills, Pa.—Bridge.—The Penn Bridge Co. has been awarded the contract at $1,932 for the erection of a bridge over Mock St.

New Castle Junction, Pa.—Train Sheds. awarded the contract of the new umbrella sheds of the Pittsburg & Lake Erie R. R.

Scranton, Pa.—Bridges.—It is reported that the York Bridge Co., York, Pa., has been awarded the contract at $83,997 for constructing the new steel bridge across the Lackawanna River on Lackawanna Ave., and John F. Whittaker has been awarded the contract for building a concrete bridge on Green Ridge St.

Providence, R. I.—Sewers.—The Commissioner of Public Works has awarded contracts for the building of sewers as follows: To Charles Crankshaw—Alverson Ave., Berkeley St., Lowell Ave. and Hillside Ave.; to Frederick E. Shaw—Eaton St., Elmhurst Ave. and Smith St., Laurel Ave., Elmgrove Ave. and Savoy St.

Brookings, S. D.—Sewer System.—Gilbert M. Hagart, Fargo, N. D., has been awarded the contract, at $8,805, for new sewerage system and sewerage disposal works.

Brookings, S. D.—Water Works.—W. I. Gray & Co., Minneapolis, Minn., have been awarded the contract at $19,000 for the extension of the water system.

Bryan, Tex.—Electric Light Plant.—Wheelock & Allen have been awarded the contract for erecting the new lighting plant.

Houston, Tex.—Paving.—W. S. Hipp has been awarded the contract for the paving of the five-mile gap on the Houston and Crosby road.

Salt Lake City, Utah.—Street Work.—Contracts were awarded for twenty-two miles of sewers and twelve miles of sidewalk as follows: Sewer extension No. 178, Davis, Heiser & Drake, $31,534.70; sewer extension No. 180, James Kennedy, $144,145.75; sewer extension No. 182, James Kennedy, $68,724.04; sidewalk extension No. 89, S. Birch, $68,635.95; sidewalk extension No. 121, Johnson & Bascom, $4,112.95.

Richmond, Va.—Macadam Roadway.—James P. Bradley & Co., Richmond, have been awarded the contract for the construction of a macadam roadway from Leesburg to the Balls Bluff National Cemetery.

Norfolk, Va.—Asphalt Paving. — The Barber Asphalt Paving Co. have been awarded the contract at $2.38 per sq. yd. for three blocks of asphalt paving on Marshall Ave. Work to be completed by Sept. 30.

Tacoma, Wash.—Asphalt Paving.—The Barber Asphalt Paving Co. has been awarded the contract at $41,800, for asphalt paving in district No. 325, which comprises the streets south of the Northern Pacific depot site, and George Milton Savage was awarded the contract at $141,887, for paving the streets in district No. 330 between St. Helens Ave. and K St.

Tacoma, Wash.—Sewer.—The Lister Construction Co. have been awarded the contract at $34,450, for the building of a sewer in the North End.

Olympia, Wash.—Road Work.—The Tacoma Bridge Co. has been awarded the contract at $29,750, for the construction of three miles of state-aid road between Riverside and Benton Junction.

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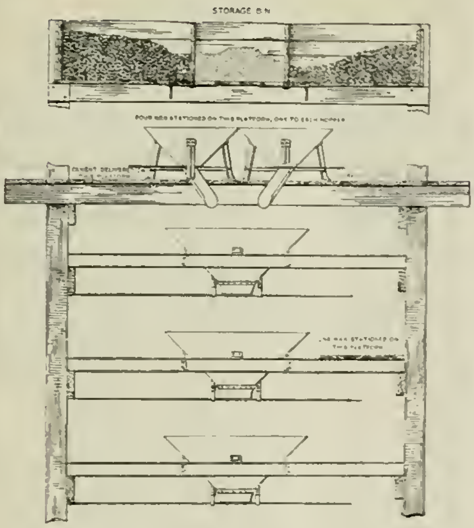
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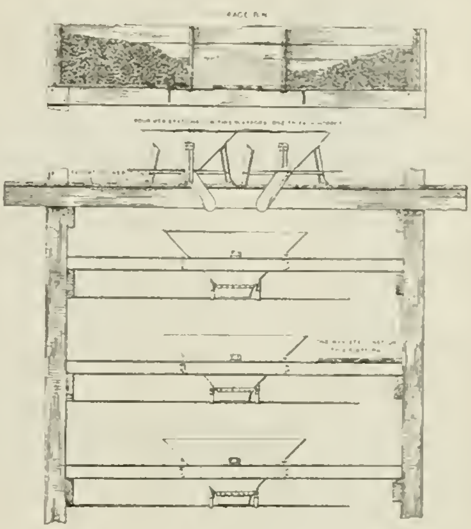

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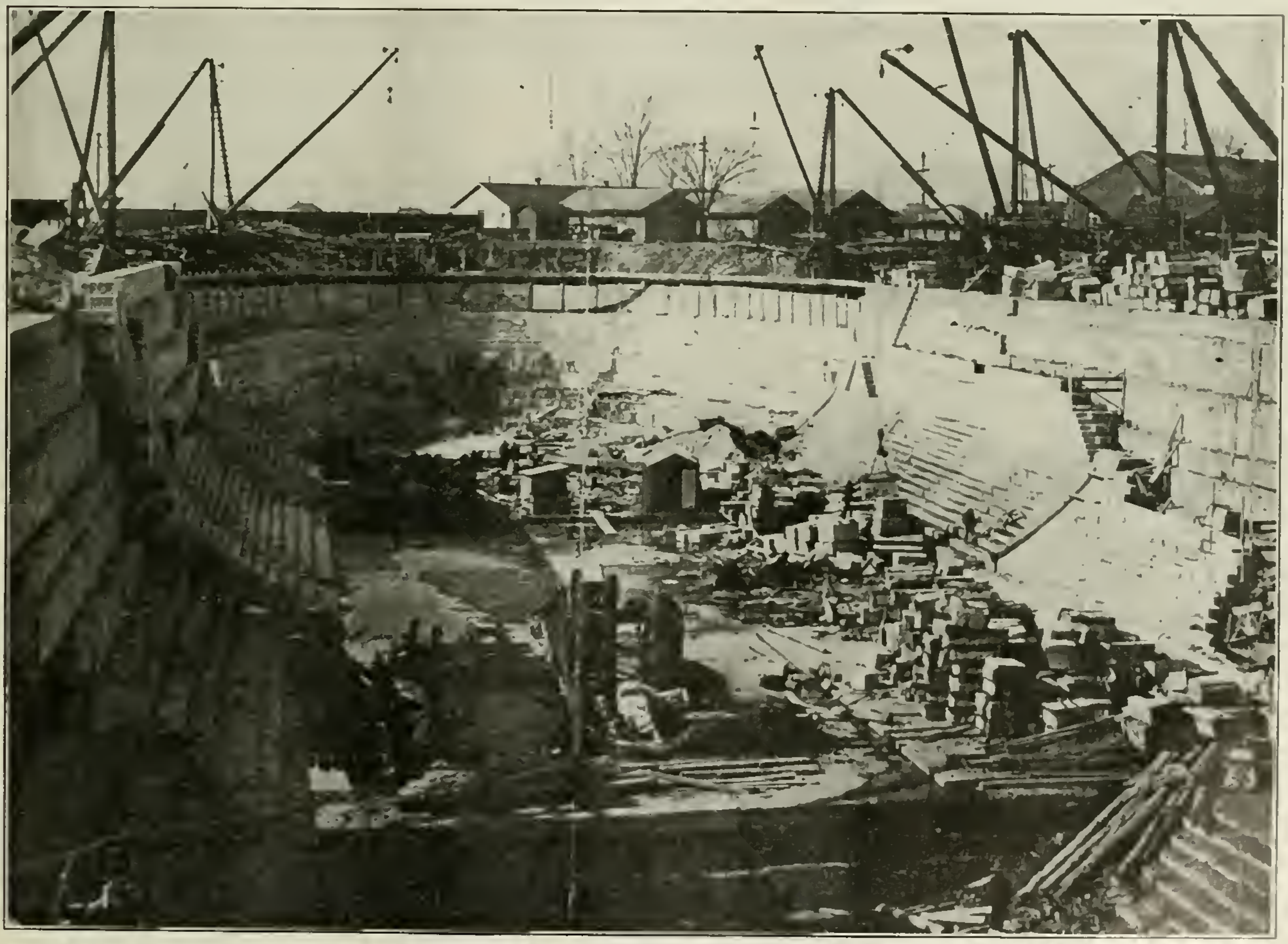

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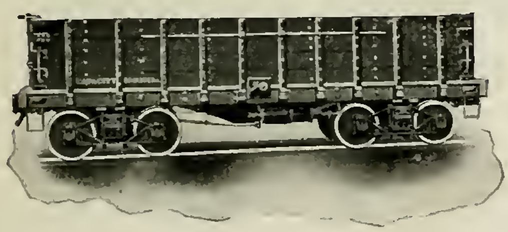

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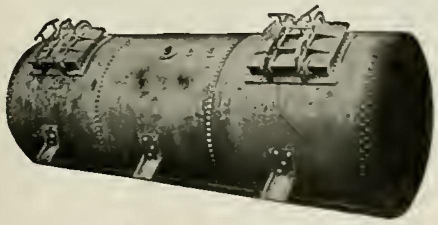

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Our Series of Articles on the Cost of Railroad Buildings.

In this issue we print the first article of a series on the cost of railway buildings. We shall give the itemized cost of labor and materials required in the construction of many depots, section houses, tool houses, ice houses, round houses, coal bunkers, platforms, storage houses and sheds, turntables, etc. We shall also print standard plans and bills of materials. This will be the first comprehensive presentation of the cost of railway buildings that has ever been published. We believe it will prove of great value, not only to civil engineers and contractors engaged in railway work, but to all engineers and contractors who are engaged in general practice, or expect to be so engaged. The young man frequently thinks that he will never have use for any data outside of a few facts of direct value in the particular line of work that he happens to be engaged in doing. He does not realize that the chances are many to one that he will be called upon to do work wholly different from what he may have chosen as his life's "speciality." Today he is planning to become a sanitary expert. A year from today he may be building a lighthouse. In the field of civil engineering, and of engineering contracting, nothing is so difficult as to stick to a specialty. Other work is forced upon us whether we will or not. The man who has a broad knowledge is much more likely to rise to emergencies than the man who has attempted to specialize too much. To those of our own readers who are too busy to read all that we shall print in these articles on railway buildings, we suggest the advisability of reading at least a part, not only for the side lights that they will throw on the costs of other work of a seemingly different nature, but for the knowledge where to look, in cases of emergency, for reliable data on building construction.

Reasons Why Every Contractor and Every Engineer Should Join the Am. Soc. Eng. Contr.

Many of our readers who have applied for membership in the American Society of Engineering-Contractors may have wondered at the seeming delay in organizing the society. To them a word of explanation is in order, and to others who have not yet applied for membership, an urgent appeal to join is in order.

Shortly after we began regularly printing the society application blank in our advertising pages, the postal authorities ruled that no coupon blanks could be printed in any periodical having second-class mailing rates. Believing that this ruling would be rescinded, we decided to wait a few weeks or months if need be, until we could again print application blanks. It is true that we might have mailed such blanks, but to have done so would have entailed an expense of several hundred dollars even for one mailing. Those who are familiar with matters of this sort know that only a certain small percentage of replies are ever received from one such appeal. It requires many appeals to secure answers in sufficient numbers to justify the organization of a national society on such a scale as absolutely to insure its permanent success.

While the American Society of Civil Engineers was started with only fifty charter members, we must remember that it was a long time before it became a large and powerful organization. Had some periodical taken upon itself the task of securing a large membership for the American Society of Civil Engineers, that society might have leaped at once into prominence. Reasoning thus, the managing editor of Engineering-Contracting determined to work two years, if need be, to secure a large charter membership for the American Society of Engineering Contractors. Now it is eighteen months since the first application for membership was received, and, judging by the rate that new members are coming in since we began printing application blanks, the new society should be started on its career before the end of the year 1907.

We shall soon print a list of charter members, several hundred in all, and your name should be on the list, whether you are a contractor or an engineer. The American Society of Engineering Contractors is, as its name implies, primarily a society of contractors engaged in building engineering structures, but, to be of the greatest usefulness it should have as many engineers among its members as it has contractors. It has been a great pity that in the past engineers and contractors have had no common meeting ground where matters of mutual interest could be threshed over. Every engineer, for example, is anxious to have specifications that will secure good honest work at a reasonable price, yet how often does an engineer consult a contractor as to a specification that he is preparing? Here, in this American Society of Engineering Contractors, will be the place for such consultation, whether by word of mouth or by mail.

Here, too, a contractor can go on record as to his experience, so that to be a member of the American Society of Engineering Contractors will be a badge of business honor.

As we have pointed out before, engineering contractors are practically helpless in dealing with labor unions having national membership, simply because there is no similar national organization of contractors. Strength must be met with strength if fairness is to prevail in the relations between employers and employes. Weakness invariably wins contempt where man meets man. And there is no weakness more puny than weakness through lack of organization. A score of Russian Cossacks whips a mob of thousands into obedience, because the score of Cossacks is an organized unit acting as one individual —a giant welded out of twenty men, before whom the mob retreats in terror. In far greater degree is any individual employer more helpless in the face of unreasonable demands made by an organized body of his employes. His very weakness tempts his men to become unreasonable.

Labor unions have, undoubtedly, a great and useful part to play, but, as yet, they are often led by men who are fanatical in their enmity to all employers. One has but to read the average paper published by labor unions to be aroused to the dan-

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ger that already exists. There must be organized effort to meet the sophistical arguments of such union papers, for some of them are working incalculable damage. The pictures they paint are, indeed, not unlike those that the Boxers circulate in China to rouse hatred against the "foreign devils." The "foreign devil" in America is the employer, the man who gives an eight-hour day to his men and reserves a sixteen-hour day for himself.—but the men never hear of his sixteen hours of work or worry. He is always pictured in idleness, a monster riding upon the backs of the poor.

"Who are the producers of America?" asks a union paper, and it answers: "You who use your hands, and only you. The rest are parasites."

A week ago the writer stood in a field, a field of California wheat, and watched a great machine cutting a swath of grain thirty feet in width, and moving at a speed that enabled it to harvest eighty acres in a day. Behind the machine lay heaps of straw, and at short intervals lay the bags of grain ready for the market. Upon the machine rode eight men, and had you asked them who had done all this work they would have pointed at themselves, no achievement—ten acres to the man—for they have been taught to believe that only the man who handles the tool is the producer.

Yet who can justly make such claims as this? Two thousand miles away from these eight men are other men and other machines and they are mining and making steel—steel such as this harvester is made of. Are they not sharers in the credit for this achievement on the plains of California? Yet back of them all are other men, the mining and the civil and the mechanical engineers, the inventors whose genius has made possible the mining, the transportation and the fabrication of the metal of which these harvesters are made. And then, to come more nearly home, there stood the man who had designed the mechanism that these eight men controlled. But even he was not the only essential factor, for near by was the man who owned the machine and markets the product—the farmer. By his frugality and hard toil in early life he has made it possible for these eight men to escape the drudgery of cutting that grain by hand. Little do they think, however, of that as they ride and guide this steam leviathan. The least that any of these eight men earns is three dollars a day. In China three men will work for a week and get less, less not merely in money but in what money buys. Are these eight Americans so much better workers than so many Chinamen? Not a bit of it. Put eight Chinamen on that harvester and they will soon learn to do as well. Who, then, is the true producer of these eighty odd acres of harvested grain? The eight who claim it? Who that pauses to analyze the facts can fail to see that the man who invents, the man who finances the invention, and the man who applies the invented article are all as truly producers as the men who use it in its perfected form.

This is a side of the picture that labor union organs never print. It is time that some vigorous organization began a campaign of education among the members of labor unions, and what more fitting than that organization should be the American Society of Engineering Contractors?

On one of our advertising pages will be found an application blank for membership in the society. Will you not sign it now and urge your friends to join?

The Cost of Four Frame Depots.

This is the first of a series of articles that we shall publish on the cost of railway buildings. While they are typical railway structures, still the cost data will be found equally valuable in estimating the costs of buildings erected for other purposes. It is a fact not generally known that the labor cost of framing and erecting plain buildings averages from $10 to $15 per 1,000 ft. B.M. This fact will be clearly brought out in these articles, and it will be of great assistance to anyone who is called upon to estimate the cost of a plain frame building. Wages will be given in each case, but the reader is cautioned against supposing that an increase in wages necessarily involves a corresponding increase in cost. A high priced carpenter is usually more efficient than a low priced carpenter, the very fact that he is high priced often being evidence in itself that he is correspondingly more competent than the low priced man. A contractor who pays $3.50 a day for carpenters will usually get more work done for the money than will a railway company that pays $2.50 a day for its "company carpenters." Railways have a policy of paying very low wages, under the mistaken idea that they are economizing thereby. In consequence, they usually secure lazy or incompetent day workers. Perhaps, with their present lack of system in keeping costs of construction, the railways would gain nothing by employing higher priced men.

The work that we are about to describe was done by "company forces," carpenters receiving $2.50 for 10 hours. As is usually the case in day labor jobs, the men were very slow, but in subsequent articles we shall print standard plans and itemized bills of materials.

The method of summarizing the costs of buildings is our own. Records kept by railways are usually so jumbled up as to be of no use either in comparing the costs of similar structures or in ascertaining whether the cost of any particular structure has been reasonable or not. This is largely because the engineering department is not in charge of building construction, or, if it is in charge, the engineers take little interest in work which does not seem to be engineering. There is crying need for cost analysis engineering in the management of all building construction, but particularly on railways.

The cost of those plain frame depots may be conveniently distributed under seven headings:

Lumber,
Shingles,
Millwork,
Hardware,
Paint,
Masonry,
Labor.

The first six items cover the materials. The labor item can be subdivided to suit each particular kind of work.

The weight of each building of standard design should be estimated, so that the items of freight and team haulage can be accurately predicted, but this is rarely done by railway companies.

The number of square feet of ground floor area should be stated, and the cost of each building reduced to costs per square foot, both in dollars and cents and in percentages.

Cost of a 24x60 ft. Depot.—This was a small combination passenger and freight depot, of very plain design, without a masonry foundation and without plastering. The building was one story, 24x60 ft., surrounded by a wooden platform in front and ends, and a cinder platform extension.

This depot had an area of 1,440 sq. ft., exclusive of the platform, and its cost was as follows:

Weight:

30 M at 3,300 lbs.	99,000 lbs.
20 M shingles at 150 lbs.	3,000 lbs.
Millwork	1,000 lbs.
Hardware	1,600 lbs.
1,100 brick	6,000 lbs.
Total—55 tons	110,600 lbs.

Lumber:		
8,025 ft. B. M. at	$ 8.00	$ 64.20
12,800 ft. B. M. No. 2 com. S. 1. S. at	8.50	108.80
1,400 ft. B. M., 1 in. oak, at	10.00	14.00
3,000 ft. B. M., ¾x8 ft. to 18 ft., at	14.00	42.00
2,700 ft. B. M., No. 2 D siding, at	14.40	38.88
1,100 ft. B. M., No. 3 flooring, at	12.00	13.20
832 ft. B. M., No. 1 flooring, at	19.10	15.89
30,057 ft. B. M., total lumber	$13.23 av	$296.97
Shingles:		
20 M. shingles at	$ 1 10	$ 22.00
Millwork:		
900 lin. ft. miscel. moulding, at	1c	$ 9.00
225 lin. ft. 5 in. crown moulding, at	3c	6.75
1 transom, 3 doors, 9 windows		24.00
Frames for doors and windows		16.00
Total millwork		$ 55.75

Hardware:		
8 rolls tar paper at...	75c	$ 6.00
900 lbs. nails, at.......	2½c	22.50
Locks, knobs, hinges, etc.		9.00
Total hardware		$ 37.50
Paint:		
Paint, 23 gals., at......	70c	$ 16.10
Masonry:		
Brick, 1,100, at	$ 8.00	8.80
Labor:		
Building depot:*		
38 days foreman, at..	$80.00mo.	$ 98.38
87 days carpenter, at.	2.50	217.50
51.2 days helper, at...	1.75	90.05
176.2 days total, at...	$ 2.32 av.	$406.38
Putting up ladders:		
2 days carpenter, at..	$ 2.50	$ 5.00
Painting depot:		
14 days helper, at....	$ 1.75	$ 24.50
Building chimney:		
4 days mason, at.....	$ 4.00	$ 16.00
Filling cinders in platform:		
2 days section foreman, at	$50.00mo.	$ 3.20
6 days labor, at.........	1.05	6.30
8 days labor, total......		$ 9.50
Tools		$ 38.50

SUMMARY.

	Totals.	Per Cent.
30,057 ft. B. M., at $13.23....	$296.97	33.2
20 M. shingles, at $1.10..	22.00	2.4
Millwork	55.75	6.1
Hardware	37.50	4.1
23 gals. paint, at 70c.....	16.10	1.8
1,100 brick, at $8.00........	8.80	1.0
Total materials.....	$437.12	48.6
176.2 days labor building, at $2.32	$406.38	45.3
2 days labor, put up ladders, at $2.50.....	5.00	0.6
14 days labor, painting, at $1.75	24.50	2.8
4 days labor, building chimney, at $4.00.....	16.00	1.8
8 days labor, filling cinders, at $1.20	8.50	0.9
Total labor	$460.38	51.4
Total materials and labor..	$897.50	100.0
(Est.) freight 55 tons, 200 mi., ½c ton mile.......	$ 55.00	
	$952.50	
Tools (excessive in this case	$ 38.50	
Grand total	$990.00	

	Per sq. ft.	Per cent.
Materials	$0.304	44.2
Labor	0.319	46.5
Freight	0.038	5.5
Tools	0.027	4.0
Total	$0.688	100.0

It will be noted that the price of lumber was very low.

The total labor was $460, which is practically $15 per 1,000 ft. B. M. in the depot and platform. If we exclude the labor of building the chimney, painting the depot and spreading the cinder platform, the labor cost $406, or about $13 per 1,000 ft. B. M., yet some time was lost by the crew waiting for lumber to arrive. This lost time should have been recorded, but was not.

Cost of Another 24x60 *ft. Depot.*—This depot was similar to the last, except that 7,200 ft. B. M., of second-hand car sills (8x16 in.), were used for posts and stringers of the platform. Grading of the depot grounds was an unusually expensive item.

Lumber:		
8,000 ft. B. M., at $ 8.50........		$ 68.00
7,200 ft. B. M., (8 in. x 16 in.) second-hand at.	4.00*	28.80
6,400 ft. B. M., S. I. S., at	10.00	64.00
8,900 ft. B. M., S. I. S., 1 in., at	12.00	106.80
1,050 ft. B. M., com. floor, at	12.50	13.12
3,600 ft. B. M., com. ceiling, at	12.50	45.00
900 ft. B. M., clear floor, at	21.00	18.90
2,600 ft. B. M., drop siding No. 2, at.......	21.00	54.60
300 ft. B. M., com. ceiling, at	15.00	4.50
38,950 ft. B. M., total lumber		$403.72
Shingles:		
23 M. shingles, at........	$ 1.60	$ 36.80
Millwork:		
1,200 lin. ft. molding, at ¾c av.		$ 9.00
Doors and windows and frames		70.00
Total millwork		$ 79.00
Hardware:		
5 rolls tar paper at......	70c	$ 3.50
Locks, knobs, hinges, etc..		6.00
1,400 lbs. nails, at........	2¼c	35.00
Total hardware		$ 44.50
Paint:		
34 gals. paint, at	75c	$ 25.50
16 gals. boiled oil and turp.		9.00
10 gals. Roger's black paint, at	$ 2.00	20.00
Total paint		$ 54.50
Masonry:		
1 M. brick		$ 8.00
Labor:		
Unloading lumber:		
2 days, carpenter, at....	$ 2.50	$ 5.00
7 days, helper, at......	2.00	14.00
9 days, total, av. at.....	2.10	$ 19.00
Building and painting depot:		
33 days, foreman, at $80.00 month		$ 86.66
140.2 days, carpenter, at..	$ 2.50	350.50
74.1 days, helper, at.....	2.00	148.20
247.3 days, total, av. at...	$ 2.41	$585.36
Grading depot grounds:		
5 days, section foreman, at $65.00 month....		$ 10.45
153 days, section men, at.	$ 1.10	168.45
158 days, total grading...........		$178.90
Tools		$ 26.00

SUMMARY.

Materials:	Totals.	Per cent.
38,950 ft. B. M., lumber..	$ 403.72	32.7
23 M. shingles, at $1.60..	36.80	3.0
Millwork	79.00	6.3
Hardware	44.50	3.6
44 gals. paint, and 16 gals. oil and turp.	54.50	4.4
1,000 brick	8.00	0.6
Total materials	$ 626.52	51.0
Labor:		
9 days, unload lumber, at $2.11	$ 19.00	1.6
247.3 days, building, at $2.41	585.36	47.4
Total labor	$ 604.36	49.0
Total materials and labor.	$1,230.88	100.0
Freight, 70 tons at $1.00..	70.00	
Tools	26.00	
Grading depot grounds ..	178.90	
Grand total	$1,505.78	

	Cost per sq. ft.	Per cent.
Materials	$0.436	41.7
Labor	0.420	40.2
Freight	0.049	4.7
Tools	0.016	1.6
Grading	0.124	11.8
Total	$1.045	100.0

It will be noted that the labor on the depot, exclusive of grading the grounds, amounted to $604. This is a trifle more than $15.50 per 1,000 ft. B. M.

It will be noted that the paint for this depot cost four times what paint cost for the other depot, indicating the necessity of so classifying costs as to enable comparisons to be quickly made with a view to discovering "leaks."

Cost of a 30x48 *ft. Depot.*—This depot has the same area, 1,440 sq. ft., as those previously described, but is wider and shorter. The labor of building this depot cost $542, which is equivalent to a little more than $13 per 1,000 ft. B. M. The itemized cost was as follows:

Weight:	Lbs.
41 M at 3,300 lbs.	135,300
21 M shingles, at 150 lbs........	3,150
Millwork	1,000
Hardware	1,600
1,000 brick	6,000
6. bbls. cement..................	2,400
Weight, 75 tons	149,450

Lumber:		
10,255 ft. B. M., at	$ 7.00	$ 71.79
10,940 ft. B. M., S. I. S. 2E	7.50	82.05
3,920 ft. B. M., S. I. S....	7.50	29.40
4,600 ft. B. M., No. 2 boards	11.90	54.74
2,800 ft. B. M., 1x6 siding	14.00	39.20
1,100 ft. B. M., 1x4 flooring, D. M.	10.00	20.90
1,700 ft. B. M., 2x6 selected, D. M.	8.50	14.45
139 ft. B. M., S. 4 S., No. 2 clr.	17.00	2.36
568 ft. B. M., S. I. S...	10.00	5.68
200 ft. B. M., S. 4 S....	19.00	7.28
4,437 ft. B. M., 8 in. x 16 in., S. H.	4.00	17.75
40,729 ft. B. M., total av..	8.50	345.60
21 M. shingles	$ 1.75	$ 36.75
Millwork:		
1,380 lin. ft. molding at ¾c.....$		10.35
Windows, doors, and frames....		48.00
Total		$ 58.35
Hardware:		
11 rolls tar paper at 65c........$		7.15
750 lbs. nails at 2¼c............		16.90
Locks, knobs, hinges, etc........		5.60

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*The men were "held up" waiting for lumber.

Miscellaneous	9.00
Total	$ 39.25

Paint:

30 gals. outside paint at 60c	$ 18.00
20 gals. inside paint at 85c	17.00
Total	$ 35.00

Masonry:

1,000 brick at $9.00	$ 9.00
24 sacks cement at $1.00	24.00
3 sacks lime at 60c	1.80
Total	$ 34.80

Labor:

Unloading material:

1 day foreman at $80.00 month	$ 2.67
5 day carpenters at $2.50	12.50
10 day helpers at $2.00	20.00
16, total av. $2.20	$ 35.17

Put in foundation:

5 day carpenters at $2.50	$ 12.50
4 day helpers at $2.00	8.00
9, total av. $2.30	$ 20.50

Building depot:

27 days, foreman, at $80.00	$ 69.77
87.5 days, carpenter, at $2.50	218.75
50.5 days, helper, at $2.00	101.00
165 days, total av. $2.36	$389.52

Painting depot:

6 days, carpenter, at $2.50	$ 15.00
9 days, helper, at $2.00	18.00
15 days, total av. $2.20	$ 33.00

Excavating for platform and privy:

9 days, helper, at $2.00	$ 18.00

Unloading cinders and build cinder platform:

18.5 days, helper, at $2.00	$ 37.00

Building chimney:

1.5 days, bricklayer, at $3.50	$ 5.25
2.0 days, helper, at $2.00	4.00
3.5 days, total av. $2.70	$ 9.25
Tools	$ 60.00

SUMMARY.

	Totals.	Per cent.
Materials:		
40,729 ft. B. M., at $8.50	$ 345.60	31.8
21 M. shingles at $1.75	36.75	3.4
Millwork	58.35	5.3
Hardware	39.25	3.5
Paint	35.00	3.2
Masonry	34.80	3.2
Total	$ 549.75	50.4
Labor:		
16 days, unloading, $2.20	$ 35.17	3.2
9 days, put in foundation, at $2.30	20.50	1.9
165 days, build depot, $2.36	389.52	35.8
15 days, paint depot, $2.20	33.00	3.0
9 days, excavation, $2.00	18.00	1.6
18.5 days, build cinder platform, $2.00	37.00	3.3
3.5 days, build chimney, $2.70	9.25	0.8
Total labor	$ 542.44	49.6
Total materials and labor	1,092.19	100.0
Tools (excessive)	60.00	
Total	$1,152.19	
Freight, 75 tons, 200 mi., at ½c ton mile	75.00	
Grand total	$1,227.19	

	Cost per sq. ft.	Per cent.
Materials	$0.385	44.8
Labor	0.378	44.0
Tools	0.042	5.0
Freight	0.052	6.2
Total	$0.857	100.0

Cost of a 30x60 ft. Depot.—This depot is of the same general type as the others, but larger, having an area of 1,800 sq. ft. It will be noted that it contains a large amount of second-hand car sills (15,200 ft. B. M.), used in building the platform. The labor cost was $714, or nearly $12 per 1,000 ft. B. M. The labor of painting the depot was very high. The cost of the paint was not $20, yet the labor of painting was nearly $70.

The itemized cost of the depot was as follows:

Weight:	Lbs.
61,000 ft. B. M., at 3.300	201,000
26 M. shingles, at 150	3,900
Millwork	1,000
Hardware	1,600
Brick	6,000
Stone	21,600
Total weight, 118 tons	235,100

Lumber:

8,108 ft. B. M., at $8.50	$ 51.92
6,912 ft. B. M., at $8.50	58.75
1,440 ft. B. M., S. 1 E., $8.50	12.24
3,700 ft. B. M., boards, $8.50	31.45
4,300 ft. B. M., S. 1 S., $9.00	38.70
9,189 ft. B. M., S. 1 S., $9.00	82.70
10,900 ft. B. M., No. 2 floor, ceiling, and siding, $18.50	201.65
408 ft. B. M., No. 2, S.4 S. $26.00	10.63
836 ft. B. M., S. 1 S., $25.00	20.90
70 ft. No. 2 S. 4 S., $1.00	2.17
15,200 ft B. M., 8 in. x 16 in., S. H. (for platform), $4.00	60.80
61,063 ft. B. M., total av. $8.73	$531.91

Shingles:

26 M. shingles, $1.72	$ 45.00

Millwork:

1,540 ft. moulding at 1c	$ 15.40
6 doors, 9 windows and frames	60.60
Total	$ 76.00

Hardware:

11 rolls bldg. paper, 57c	$ 6.27
900 lbs. nails, 2½c	22.50
Locks, knobs, hinges, etc	21.00
Total	$ 49.77

Paint:

13 gals. O. B. paint, 50c	$ 6.50
14 gals. boiled oil, 37½c	5.25
16 gals. inside paint, 50c	8.00
Total	19.75

Masonry:

1,000 bricks, $9.00	$ 9.00
144 cu. ft. undressed stone, 70c	100.80
1½ bbls. lime, 85c	1.28
Total	$111.08

Labor:

Unloading material:

6.5 days, carpenter, $2.50	$ 16.25
17.7 days, section men, $1.15	20.35
24.2 days, total av. $1.50	$ 36.60

Trucking* lumber:

1 day foreman at $80.00 mo	$ 2.85
5 days, carpenter, $2.50	12.50
29.5 days, helper, $2.00	59.00
35.5 days, total av. $2.09	$ 74.08

Clearing snow off timber:

3 days, helper, at $2.00	$ 6.00

Erecting depot:

21 days, foreman, $80.00 mo	$ 54.19
114 days, carpenter, $2.50	285.00
24 days, helper, $2.00	48.00
159 days, total av. $2.44	$387.19

Painting depot:

2 days, foreman, $80.00 mo	$ 5.16
1 day, carpenter, $2.50	2.50
31 days, helper, $2.00	62.00
34 days, total av. $2.05	$ 69.66

Unloading cinders:

10.8 days, section foreman, $55.00	$ 19.19
7.0 days, section laborers, $1.20	7.95
15.1 days, section laborers, $1.05	15.90
32.9, total av. $1.30	$ 43.04

Build platform:

7 days, foreman, $80.00	$ 18.07
17.6 days, carpenter, $2.50	44.00
11.2 days, helper, $2.00	22.40
35.8 days, total av. $2.36	$ 84.47

Build privy:

5.4 days, carpenter, $2.50	$ 13.50
Tools	$ 51.00

SUMMARY.

	Totals.	Per cent.
Materials:		
61,063 ft. B. M., $8.73	$ 531.91	34.4
26 M. shingles, $1.72	45.00	2.9
Millwork	76.00	4.9
Hardware	49.77	3.2
Paint	19.75	1.3
Masonry	111.08	7.2
Total	$ 833.51	53.9
Labor:		
24.2 days, unload, $1.50	$ 36.60	2.4
35.5 days, trucking, $2.09	74.08	4.7
3.0 days, clear snow $2.00	6.00	0.4
159.0 days, erect depot $2.44	387.19	25.0
34.0 days, paint depot $2.05	69.66	4.5
32.9 days, unload cinders $1.30	43.04	2.8
35.8 days, build platform, $2.36	84.47	5.5
5.4 days, build privy, $2.50	13.50	0.8
Total	$ 714.54	46.1
Total materials and labor	$1,548.05	
Tools	51.00	
Total	$1,598.05	
Freight, 118 tons	118.00	
Grand total	$1,716.05	

	Cost per sq. ft.	Per cent.
Materials	$0.463	48.6
Labor	0.397	41.6
Tools	0.028	2.9
Freight	0.066	6.9
Total	$0.954	100.0

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*Note.—Track was a long distance from depot.

An appropriation of approximately $46,845,000 has been passed by the Russian government for rolling stock for the years 1907-1911 for the government railways.

The total railroad property in Wisconsin according to the annual assesment of the State Tax Commission is valued at $256,000,000. The total tax is $2,801,685.

Methods of Quarrying Granite in Aberdeenshire, Scotland.*

BY WILLIAM SIMPSON.

(Continued from Aug. 21 issue.)

Haulage.—The materials when hoisted to the surface are disposed of to different parts of the quarry bank by a system of railways. In every granite quarry there is a large quantity of excavated material of no immediate commercial value, but which has to be disposed of, and, accordingly, the larger Aberdeenshire quarries are surrounded by enormous banks of waste stone.

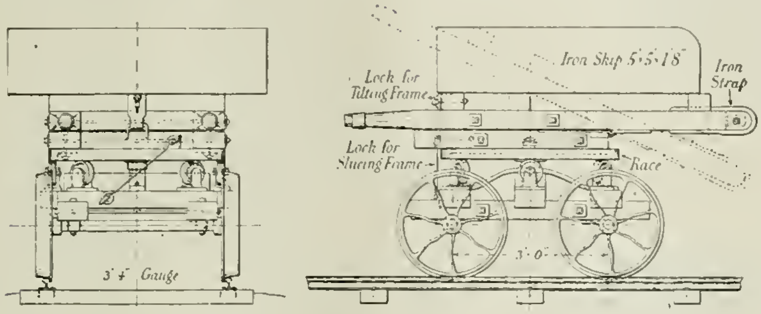

Fig. 9—Quarry Wagon with Slewing and Tipping Frame.

The cableways usually dispose of this surplus, and the waste banks are gradually pushed outwards from them, away from the quarry, and ultimately form in most quarries the sett-maker's yards, Fig. 2 (page 3). From each cableway a system of high-level railway lines is laid out upon this area in fan shape, leading to the sett-maker's stands and waste tips. The lines converge upon the cableway by a neck of single railway, which terminates upon a loading platform with siding accommodation for one or two empty wagons, Fig. 8. The whole of the high-level lines may be joined up to form one large yard, served by one or more cableways, as at Sclattie Quarry, or separate yards may be used, according to the nature of the accommodation at the quarry bank. The wagons conveying stone are hauled entirely by manual labor, and the lines are laid out with falling gradients from the cableways to enable the loaded wagons being run out with little effort. To further complete the general usefulness of the cableway a low-level line is usually laid from it to connect up to the general railway system of the quarry bank, so that ashlar and other stones dressed on the quarry floor can be hoisted and disposed of by the cableway to any part of the bank. The high-level lines of the sett-maker's yards are not usually connected directly to the low-level lines at the bank, and setts after being made and weighed are placed on the low-level lines by the cableway for conveyance to the loading banks or sett stacks. In some quarries, however, the sett-maker's yards are connected to the low-level lines by a steep self-acting incline, as at Tom's Forest Quarry. The low-level system of railway lines is usually laid at the level of the quarry bank, and connects up the bank cranes and cableways with the dressing yards, loading banks, workshops and main inclines, either directly or by branch lines.

Wagons.—The quarry waste and smaller kinds of dressed stones are hoisted from the floor in steel skips measuring 5 ft. square by 15 ins. deep, and these are placed directly upon wagons for conveyance. The type of wagon for this purpose has no body, but consists only of an under frame, on which is placed a slueing frame and a tipping frame, all of timber, Fig. 9. The slueing and tipping frames are independent of each other, and are secured by locks, and the tipping frame is nicely balanced and provided with projecting hand-shafts, so that little effort is needed to tilt the frame.

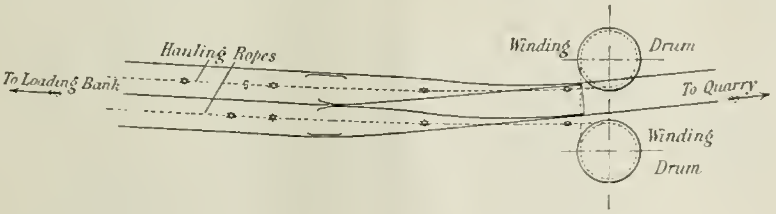

Fig. 11—Track System on Tom's Forest Incline.

Materials can thus be shot from the skips, either as a simple end tip, or radially as desired. At a few of the quarries a side-tip wagon with box body is used for supplying stone to the stone-breaking machines.

Railways.—The permanent way of the quarry lines is laid with flat-bottomed rails on cross sleepers, and the gage is usually about 3 ft. 6 ins. The rails are 3½ ins. to 4 ins. deep, in lengths of about 20 ft., and the cross sleepers are of Scotch fir, 6½ ins. wide by 2½ ins. thick, and 5 ft. long, spaced about 3 ft. apart. The rails are spiked to the sleepers with claw-headed spikes, two to each rail, and in the better-class roads the joints are made with fish-plates about 15 ins. long and ⅝-in. thick, and four fish-bolts. In the more temporary roads the rails are simply spiked down at the ends to a rather broader sleeper. The branch lines are connected by points and crossings, as the wagons are too heavy to be manipulated on plates, but wagon turntables are sometimes used where the space is limited. The points and crossings are made out of the rails of the permanent way in the quarry workshop, and rails are curved by "crowing." The switches are 5½ ft. to 7½ ft. long, tapering off from the full rail section at the heel to ½-in. thick at the point, and the crossings are 4 ft. to 5 ft. long, made by mitering two rails and riveting up the points, or by welding up the two rails solid. In the better kinds of permanent way the switches are suspended by fish-plates at the heel, but another method is to pivot the last two rails of the main track at a connection, so that they can be thrown out or in, after the manner of switches, to lead to the branch, or restore the main track as desired. Owing to the confined space at many of the quarries sharp curves are used, and the wagon shown on Fig. 9 can be worked on curves of 20 ft. radius.

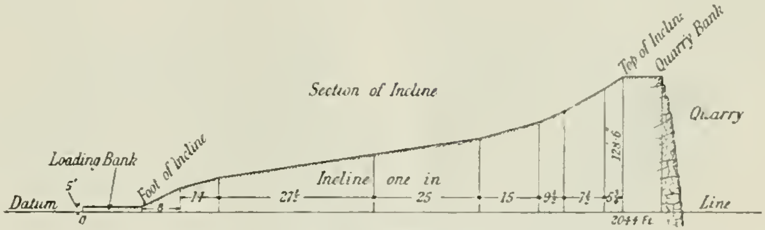

Fig. 10—Incline at Tom's Forest Quarry.

Inclines.—In many of the Aberdeenshire quarries the materials are lowered to a main line of railway by inclines. Self-acting inclines are usual, but at Kemnay Quarries the main incline to No. 1 Quarry is worked directly by a steam-winding engine at the top. This incline accommodates the wagons of the Great North of Scotland Ry., which are hauled up to the quarry from the main line, and loaded directly, connections being made between the main incline and branch lines at the quarry bank by loops and wagon turntables. The incline ascends at right angles to the main line of railway, but is curved in the upper part, and the wire ropes are guided between horizontal and vertical rollers fixed to the sleepers. A turntable is provided at the foot of the incline for assembling the wagons in the Paradise sidings, which are laid out parallel to the main line.

Of the self-acting inclines that of Tom's

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*Abstract of a paper read before the Institution of Mechanical Engineers of Great Britain at the Aberdeen, Scotland, meeting in July, 1907.

Forest Quarry may be taken as generally typical. This quarry is situated in the Alford Valley, near that of Kemnay, at a height of about 370 ft. above sea-level, and the materials are lowered by an incline about one-third mile long to the loading bank at Ratchill siding of the Great North of Scotland Ry., a height of about 130 ft., Fig. 10. The track is partly straight and partly curved, and is laid out with steep gradients at top and bottom, and a long flat gradient between, the maximum and minimum gradients being 1 in 5¾ and 1 in 27½. The permanent way consists of three rails only, laid on cross sleepers, but a wagon passing place or loop is provided in the middle of the length of the incline, with complete double tracks, Fig. 10. At the top and bottom of the incline the three rails converge into a single track of two rails, leading respectively to the quarry and to the loading bank alongside the railway, Fig. 11. The machinery consists simply of two horizontal pulleys, placed at the top of the incline, round which the hauling is coiled once, and are controlled by hand brakes, Fig. 12. The empty train is attached to one end of the hauling rope at the foot of the incline, and the full train to the other end at the top, and in descending the full train brings up the empty one. The hauling rope is guided on the straight parts of the track by horizontal rollers, and on the curved parts by horizontal and vertical rollers, arranged as shown in Figs. 13 and 14.

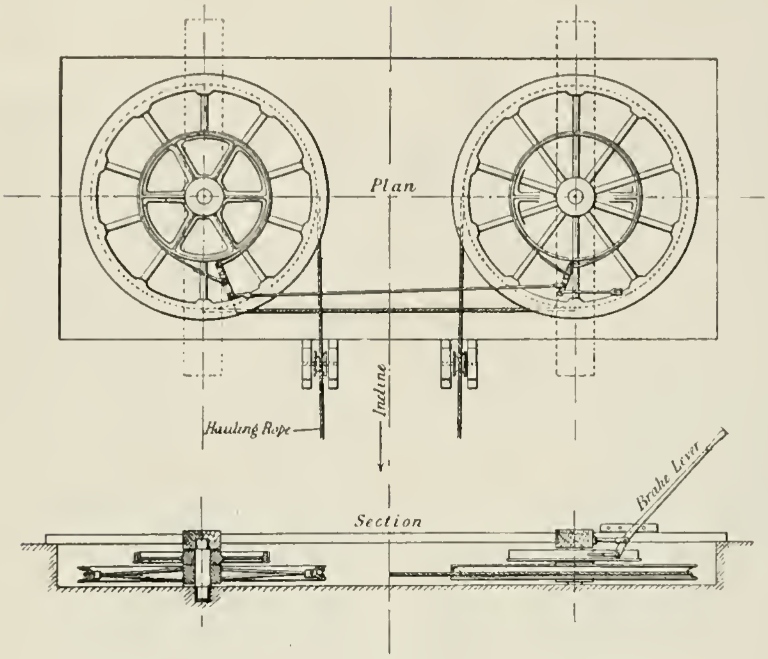

Fig. 12—Haulage Rope Pulleys at Top of Incline.

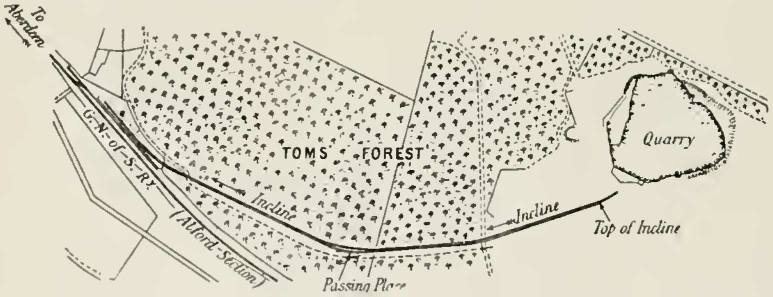

Fig. 15—Plan of Incline at Tom's Forest Quarry.

The train usually consists of three wagons each way, built with underframes similar to that of Fig. 9, on which the iron spikes are placed, or timber boxes lined with sheet iron. The loaded train weighs about 12 tons, and the incline works exceedingly well, the minimum speed being 6 miles per hour on the flattest gradient of 1 in 27½. The materials are transferred by cranes at the loading bank into railway wagons for despatch.

Roads and Accesses.—Not a few of the Aberdenshire quarries are entirely isolated from railways, and stones require to be conveyed by carts or traction engines to the nearest railway station, or to Aberdeen for shipment. In such cases service roads to the quarries have been made from the nearest public road, and are maintained by the quarry owners, while a series of cart roads is arranged at the quarry bank to give access to the various loading banks, as at Rubislaw Quarry where stones are conveyed entirely by road. Access from the bank to the quarry floor for workmen is got by one or more sets of fenced timber stairs, arranged with landings, and secured to the quarry wall, except in the case of No. 1 Quarry, Kemnay, where a two-cage lift is used, actuated by wire ropes from a winding engine.

Stone Dressing.—Granite stone is cut and dressed at the Aberdeenshire Quarries into large blocks for engineering and monumental purposes, ashlar for engineering and domestic building work, and paving setts, while rubble stone, road metal, and crushed granite are amongst the other products. After a blast a careful examination is made of the rock brought down with a view of obtaining the greatest quantity of saleable stone at the highest value. The large pieces are set aside to be cut into engineering and monumental blocks, and in descending order of size and quality the rock is apportioned to the various uses already enumerated. Large stones, beyond the power of the lifting appliances, after being tumbled on the floor, are split up into smaller pieces by a small charge of gunpowder, or by "plug and feather," which consists in boring a number of holes about ⅝-in. diameter, 5 ins. deep and 5 ins. apart, and inserting therein a series of steel "plugs" or wedges between steel "feathers" or splints of steel for the purpose of wedging the halves of the stone apart. The line of the holes is selected with particular reference to the grain of the stone, as all Aberdeenshire granites have at least one easy way of splitting, which is in the direction of the grain, and some have two, as at Kemnay.

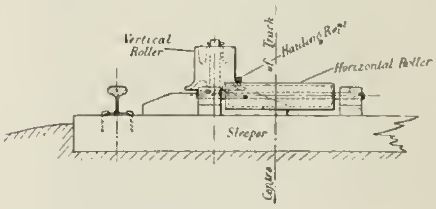

Fig. 13—Horizontal and Vertical Roller.

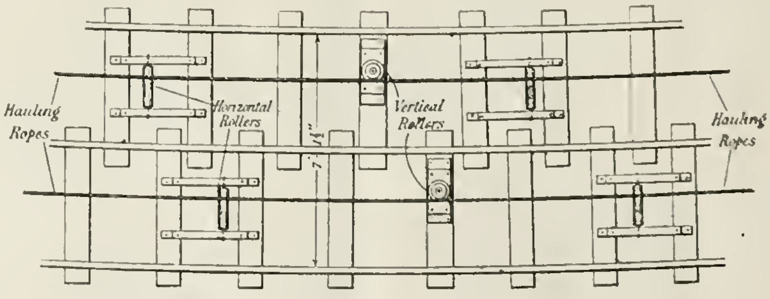

Fig. 14—General Plan of Rope Guide Rollers on Curves.

The "plugs" are driven simultaneously home by sledge hammers, and in large stones, the "plugs" are assisted by a few longer steel wedges in deeper holes. The huge blocks which can be cleanly split in two by this simple method are remarkable, provided that the holes are well removed from the edges. The "plug" drilling is usually done by hand, but both at Kemnay and Rubislaw Quarries compressed air hand-drills of the pneumatic hammer type are used. Stones for monumental purposes are usually long and thin, and the "plug" and "feather" method of splitting is not generally applicable. For such stones a small portable rock drill, mounted on a timber frame over the stone is used to drill the "plug" holes right through from side to side, at 5 ins. centres, when the selvage can then be wedged off with certainty. Slabs of rock only 18 ins. thick, 7 ft. deep, and 14 ft. to 15 ft. long can thus be successfully prepared, the holes being drilled the deep way of the stone, and leave little surplus material to be removed in fine dressing or polishing.

Further dressing of stones, however, is not undertaken at the quarries, with the exception of those belonging to the Messrs. Fyfe, and the materials intended to be highly finished are sent to the Aberdeen and Peterhead stone-cutting and polishing works, which form a large and important part of the granite industry, quite separate from quarrying. At Messrs. Fyfe's quarries special facilities are provided for the preparation of stones of the largest dimensions for engineering purposes in the form of drafting floors and dressing sheds, and stones are despatched from their various quarries completely dressed and ready to be built into place. Stones for ashlar work are split by "plug and feather" from the smaller size pieces of blasted rock, and blocked roughly to size by hammer, but are not further dressed at the quarry unless so required. The stone for granite setts is selected from the smaller rough materials, and is split by "plug and feather" on the quarry floor into blocks containing about enough material for two or three setts. The standard size of paving sett is 6 ins. deep, 3½ ins. wide, and from 7 ins. to 10 ins. long, but other sizes are made down to cubes of 4 ins., or as ordered. Out of the blocks the sett-maker forms by hand hammer the nearest standard sizes of setts, taking advantage of the natural cleavage of the stone as far as possible, but with a bad cleaving stone there is a large amount of waste, and the setts are correspondingly difficult to make. Small size setts are more costly to make than large, as they cannot be held properly, and there is more waste of stone. The setts are deposited in separate heaps according to size beside the sett maker, and are weighed upon a portable weighing wagon running on the quarry railways before being taken over by the quarry-master.

Stone Breaking.—A large quantity of stone is broken at the quarries for road making, railway ballasting, and concrete work. The broken stone usually falls by gravity through shoots into bins. The stone breakers are supplied with selected rubble stone direct from the quarry by means of a cableway, the stone being carried in steel skips which are tipped from the high level platform into hoppers leading to the machines. The broken stone is screened out into various sizes of metal by horizontal revolving screens, and drops into iron shoots leading to the different compartments of the bin, or directly into railway wagons. This method is economical of labor and requires the attendance of only two men at the hoppers. The stone breakers used are of the Baxter, Marsden, Blake, and Improved Blake types driven by steam, except at Rubislaw Quarry, where electricity is the motive power.

Quarry Workshops.—Every quarry has its own workshop, the essential feature being a smithy. At the larger quarries the workshops are of considerable size and comprise smiths', fitters' and carpenters' shops, with stores for patterns and spare gear. The largest workshops are at Kemnay Quarries, where the smithy has 16 fires and three seam hammers, and the fitting shop is equipped with turning lathes and planing and drilling machines. At Rubislaw Quarry the power-hammer is operated by compressed-air. The maintenance of the whole quarry plant and tools is undertaken by the workshops, and, as most of the quarries are situated far from Aberdeen, it is essential that a breakdown can be dealt with on the spot.

Power Supply.—The quarrying operations at the whole of the Aberdeenshire quarries, with the exception of Rubislaw Quarry, are carried out by steam power, and the supply is obtained in most cases from a central boiler house situated on the quarry bank. A main steam pipe is carried round the bank to supply the hoisting and other machinery, and another main is carried down the face of the quarry at a convenient point to supply the machinery on the floor The latter main is of steel with screwed flanges, and is usually suspended by wire ropes, and forms a source of constant trouble from its inaccessibility. The long lines of steam pipes also result in considerable loss of pressure, and, as coal is a costly item, owing to the long carriage, the supply of steam power figures high in the working expenses. With a view to economy in this respect, the proprietors of Rubislaw Quarry have recently converted their power supply from steam to electricity. Being advantageously situated in the suburbs of the City of Aberdeen, the supply of electricity has been taken from the corporation without incurrring the expenses of the initial cost of a generating plant and its subsequent maintenance. The quarry main is taken off the corporation cable in Queen's Road into the quarry offices close at hand, and there protected by automatic switches and metered before passing to the main switchboard, which is situated in the machinery house of the 20-ton crane at the quarry. The distribution is made from the switchboard by bare copper wires, forming a "ring main" round the quarry, carried on poles with porcelain insulators, and distributed to the various machines at convenient points. The supply from the corporation main is by direct current, at 440 volts, and a total of 1,000 H. P. in machines has been installed.

Cost of Shop Drawings for Structural Iron and Steel.[*]

The following data were gathered by the writer while in charge of the Drafting Department of A. Bolter's Sons' Structural Steel and Iron Works, of Chicago, Ill., during the years 1904, 1905 and 1906.

The works are divided into three different departments, the Structural Shop, the Architectural Shop and the Foundry. The Structural Shop has a capacity of 800 tons per month. The Drafting Department employs on an average seven or eight engineers. All the work is standardized with regard to details to as great an extent as possible, in order to decrease the work in the Drafting Room, yet not to such an extent that it would be difficult for the shop men to read the drawings. For example, all beam, steel and cast-iron column connections, with the exception of special cases, are not drawn and dimensioned completely, but merely indicated. The shop and drafting room have been provided with a set of the firm's standards, which have all these connections drawn out completely with dimensions and which give lists of the material.

The data here presented were taken from a great variety of work, such as public and private school buildings, churches, breweries, malt houses and elevators, grain bins, warehouses, libraries, hospitals, apartment buildings, factories and manufacturing plants, train sheds, mill buildings, office buildings, electric lighting plants and pumping stations.

Table I shows the character of the buildings and also the average cost of preparing the drawings. The cost of drafting material and blue prints is not included. Where the material for the work is to be ordered from the mill and not taken from stock, the cutting bills or mill orders are taken as being part of the details. Table II[†] shows some of the particulars of the buildings from which the data in Table I were derived and the following notes give

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[*] Rearranged from a paper by Mr. R. H. Gage, published in "The Technograph," University of Illinois, Urbana, Ill.

[†] This table has been rearranged so as to group together all structures of the same type in one place.

TABLE II SHOWING LOCATION, PURPOSE AND COST OF SHOP DRAWINGS FOR EIGHTY-FIVE STEEL BUILDINGS.

Location.	Description.	Weight in tons.	Cost of details.	Cost per ton.
1 BUILDINGS OF SKELETON CONSTRUCTION, LOADS CARRIED TO FOUNDATION ON STEEL COLUMNS.				
6. Chicago, Ill	Terminal station, elevated R R	113.0	131.60	1.17
8. Chicago, Ill	Machine shop	280.0	78.50	0.28
18. Chicago, Ill	Ornamental tower, park	260.0	723.00	2.78
34. Chicago, Ill	Remodeling and add'n club bldg	88.0	198.00	2.25
42. Chicago, Ill	Factory building	93.0	40.00	0.43
53. Chicago, Ill	Store and office building	140.0	252.00	1.80
54 Chicago, Ill	Warehouse	119.0	32.00	0.27
2. INTERIOR PORTION SUPPORTED ON STEEL COLUMNS; EXTERIOR WALLS CARRY FLOOR LOADS AND THEIR OWN WEIGHT				
7 Chicago, Ill	Apartment house	35.0	44.75	1.28
17 Chicago, Ill	Apartment house	22.0	25.00	1.14
27 Chicago, Ill	Apartment house	22.0	50.0	2.28
60. Chicago, Ill	Apartment house	13.5	18.00	1.33
61. Chicago, Ill	Apartment house	16.0	24.00	1.50
82. Chicago, Ill	Apartment house	23.0	25.50	1.11
20. Chicago, Ill	Home for girls	187.0	108.50	0.58
25. Kensington, Ill	Malt house	660.0	584.0	0.89
45 Battle Creek, Mich	Office building	50.0	324.00	6.50
46. Evanston, Ill	Store and office building	64.0	121.50	1.90
74 Chicago, Ill	Store, office and bank building	30.0	58.75	1.96
62. Evanston, Ill	Public library	129.0	570.00	4.47
72. Evanston, Ill	Library annex	39.0	231.00	5.93
75. Chicago, Ill	Branch exchange, telephone building	73.0	54.70	0.75
76. Chicago, Ill	Hall and school building	153.5	250.30	1.63
3. INTERIOR PORTION CARRIED ON CAST IRON COLUMNS, EXTERIOR WALLS CARRY FLOOR LOADS AND THEIR OWN WEIGHT.				
1. Evansville, Ind.	Complete brewery	130.0	107.40	0.83
50. Columbus, Ohio	Complete brewery	300.0	233.00	0.78
68. Nampa, Idaho	Complete brewery	101.0	84.50	0.84
86. Chicago, Ill	Complete brewery	415.0	264.50	0.64
3. Milwaukee, Wis	Stockhouse, brewery	295.0	38.20	0.13
49. Dallas, Tex	Stockhouse, brewery	26.0	17.50	0.67
79. Milwaukee, Wis	Stockhouse, brewery	32.0	52.00	0.16
15. Peru, Ill	Addition to stockhouse, brewery	55.0	19.00	0.35
16. Appleton, Wis	Brew house	45.0	23.00	0.51
19. Yankton, S. D	Brew house	25.0	15.00	0.60
26. Menasha, Wis	Brew house	25.5	15.30	0.60
25. Kensington, Ill	Malt house	660.0	584.00	0.89
44 Minneapolis, Minn	Bottling house for brewery	534.0	303.00	0.57
78. Chicago, Ill	Bottling house, brewery	38.5	35.00	0.91
83. Columbus, Ohio	Bottling house, brewery	83.0	55.50	0.67
84 Milwaukee, Wis	Bottling house, brewery	720.0	100.00	0.14
9. Chicago, Ill	Brewers' school	29.0	35.50	1.22
47. Chicago, Ill	Public school	196.0	185.00	0.95
48. Chicago, Ill	Public school	465.0	429.0	0.93
14. Chicago, Ill	Office building	108.0	61.00	0.57
70. Evanston, Ill	Store and office building	80.00	45.50	0.57
71. Chicago, Ill	Store and office building	71.0	91.50	1.29
74. Chicago, Ill	Store, office and bank	30.0	58.75	1.96
28. Chicago, Ill	Store building	30.0	23.80	0.80
33. Chicago, Ill	Store and flat building	31.0	23.00	0.74
45. Battle Creek, Mich.	Office building	50.0	324.00	6.50
29. Chicago, Ill	Catholic church	65.0	17.80	0.27
38. Chicago, Ill.	Gas house	21.5	26.00	1.21
55. South Bend, Ind	Gas house	28.0	24.30	0.87
55 Oak Park, Ill	Hospital	250.0	480.00	1.92
32. Chicago, Ill	Dock and canal, mill construction	179.0	82.60	0.46
41. Las Vegas, N. M	Car barn and power house, elec. ry	31.5	24.30	0.77
10. Chicago, Ill	Stable	43.5	19.50	0.45
37. Chicago, Ill.	Stable	40.0	10.00	0.25
4.—NO COLUMNS AND FLOOR BEAMS RESTING ON MASONRY WALLS THROUGHOUT.				
12. Evanston, Ill.	Catholic church	29.0	24.00	0.83
13. Chicago, Ill	Warehouse	181.0	93.00	0.51
73. Chicago, Ill.	Warehouse	76.5	27.00	0.35
24 Kansas City, Mo	Borter house	50.0	58.60	1.17
31. Missoula, Mont	Stock house, mercantile	23.0	27.50	1.20
43. French Lick, Ind	Sanitarium	52.5	30.00	0.57
63. Marshall, Mo	School and asylum	70.0	68.00	0.97
69 Chicago, Ill	Private hospital	20.0	23.80	1.19
5. STRUCTURE CONSISTING MOSTLY OF ROOF TRUSSES RESTING ON COLUMNS.				
5. Chicago, Ill	Bird and animal house	33.0	17.80	0.54
30 Chicago, Ill	Addition to church	22.0	77.00	3.50
36. Chicago, Ill	Pumping station	115.0	166.50	1.45
62. Evanston, Ill	Public library	129.0	570.00	4.47
85. Chicago, Ill	Refrigeration Plant	41.5	46.60	0.96
6. STRUCTURE CONSISTING MOSTLY OF ROOF TRUSSES RESTING ON MASONRY WALLS.				
4. Chicago, Ill.	Malt house, rebuilt after fire	26.5	23.90	0.90
23. Chicago, Ill	Train shed	427.5	319.00	0.75
67. Chicago, Ill.	Locomotive shops	64.0	44.00	0.69
40. Chicago, Ill	Foundry	81.0	34.00	0.42
81. Chicago, Ill	Foundry	102.0	162.50	1.59
35. Chicago, Ill	Church	34.5	94.40	2.74
76. Chicago, Ill	Hall and school building	153.5	250.30	1.63
64. Chicago, Ill	Stable	65.5	81.00	1.24

additional information about some of the work:

TABLE I.—Cost of Shop Drawings.

Type.	Character of Building.	Avg. Cost Per Ton.
1.	Entire skeleton construction, i. e., loads all carried to the foundation by means of steel columns	$1.45
2.	Interior portion supported on steel columns; exterior walls carry floor loads and their own weight	1.22
3.	Interior portion carried on cast iron columns; exterior walls support floor loads as well as their own weight	.70
4.	No columns and floor beams resting on masonry walls throughout	.85
5.	Structure consisting mostly of roof trusses resting on columns	2.47
6.	Structure consisting mostly of roof trusses resting on masonry walls	1.25
7.	Mill buildings	2.56
8.	Flat one-story shop or manufacturing buildings	.74
9.	Tipples, mining structures or other complicated structures	4.88
10.	Malt or grain bins and hoppers	2.47
11.	Remodeling and additions where measurements are necessary before details can be made	1.87

Item 2, the Faxton, Horton & Gallagher building was a fire escape of unusual size, composed almost entirely of angles, and designed for a seven-story building. It was a very light structure having railings and balusters of 1x1x¼ in. angles. This accounts for the high cost per ton for the shop drawings. The details were made of the fire escape assembled and not separate details of each piece.

Item 3, the cost of the Miller Brewing Co. stock house was unusually low, only 13c per ton. The building consisted of very heavy beams, 15 in. 60-lb I's and 20 in. 80-lb. I's. Separate details were made of each piece, but as there were many duplicates, the cost was low.

Item 8, the Fred W. Wolf Co. Building, while composed of riveted steel columns, beams and trusses, was square and the various pieces had many duplicates.

Item 18, the White City Tower consisted of 16 riveted steel columns rising to a height of about 250 ft. above the ground, with an elaborate system of diagonal angles for wind bracing. There were no floor systems throughout the entire structure. It might be interesting to state here that during the erection of this tower not a single piece had to be cut or a hole drilled and only two holes had to be reamed in the field.

Item 22, the Newaygo Portland Cement Co. tipple was similar to the ordinary coal tipples. The details were made of the structure assembled, and show all necessary views and sections.

Item 23, the Sears, Roebuck & Co. train shed was composed of a long row of trusses resting on masonry walls and anchored to same, with a hip roof at one end and vertical framing for glass at the other end.

Item 30, the Welsh Presbyterian Church consisted of a very complicated hip and valley roof whose trusses rested on steel columns built in the walls.

Item 35, the Diversey Boulevard M. E. Church was composed of a hip roof, but

Location.	Description.	Weight in tons.	Cost of details.	Cost per ton.
7.—MILL BUILDINGS.				
66. Chicago, Ill	Foundry.	76.0	82.60	1.09
8.—FLAT ONE-STORY SHOP OR MANUFACTURING BUILDINGS.				
52. Hawthorne, Ill.	Carpenter shop	45.0	25.00	0.56
58. Chicago, Ill.	Machine shop	51.0	68.00	1.33
59. Hawthorne, Ill	Shop and kiln building	388.5	171.00	0.44
9.—TIPPLES, MINING STRUCTURES OR OTHER COMPLICATED STRUCTURES.				
2. Kansas City, Mo.	Fire escape	17.0	85.80	5.05
22. Nawaygo, Mich.	Tipple, cement works	7.5	32.00	4.26
39. Ruby, Mont.	Steel flume and bridge	47.0	378.00	8.45
80. Chicago, Ill.	Tank support	10.0	58.00	5.80
10.—MALT OR GRAIN BINS OR HOPPERS.				
57. Columbus, Ohio	Steel bins and hoppers	19.0	68.40	3.60
77. Minneapolis, Minn.	Grain elevator	111.0	93.50	0.84
11.—REMODELING AND ADDITIONS WHERE MEASUREMENTS ARE NECESSARY BEFORE DETAILS CAN BE MADE.				
11. Chicago, Ill.	Consistory, remodeled	120.0	58.60	0.49
21. Chicago, Ill.	Building, remodeled	26.0	43.00	1.66
56. Chicago, Ill.	Bridge between buildings	28.0	121.50	4.35
57. Chicago, Ill.	Chinese restaurant	61.0	64.50	1.05

the trusses rested on and were anchored to the masonry walls.

Item 36, the Lawrence Avenue Pumping Station consisted of trusses supporting a hip roof resting on masonry walls, a crane runway of 24 in. 80-lb. I-beams resting on Z-bar columns, and floor beams resting on concrete walls.

Item 39, the Conrey Placer Mining Co.'s structure was very complicated, and consisted of a long steel flume supported by a bridge-like truss, and other placer mining devices, such as sluice gates, grizzleys. The structure was of comparatively light weight, and there being no duplicate parts, the cost of details was high.

Item 44, the Minneapolis Brewing Co. Bottling House is a fire-proof structure with two floors and a roof. The floor beams rest on the exterior masonry walls and frame into cast iron columns on the interior. The roof is supported by small trusses resting on cast-iron columns and the exterior walls.

Item 45, the Jos. M. Ward building was a store and office building built partly over a small river. The foundations for the columns were laid in the river bed, and those columns which came in contact with the water were made of cast iron and braced in all directions with 1¼ in. sway rods, while the remaining columns were of steel. Riveted plate girders under the first floor spanned the river which flowed almost directly under the building.

Item 54, the DuPont Building was a warehouse of the ordinary skeleton construction and very plain and square. All the columns were practically alike, and the beams were similar for all floors, hence the low cost for the details.

Item 56, the Carson, Pirie, Scott & Co. bridge consisted of a double bridge or passageway across an alley connecting their two buildings. As the walls of each building were only curtain walls, the girders rested on columns next to the walls running from the ground up. All measurements such as floor heights and distances between walls had to be taken at the building, and the expense incurred for taking these measures is included in the cost of details.

Item 62, the Evanston Public Library, while a low two-story building with all floor beams and trusses resting on masonry walls, except for a few interior cast iron columns, had a very crooked hip and valley roof, also suspended ceilings and skylights. The ceiling and skylight were made of small tees and channels, and hung from the roof trusses.

Item 64, the Knickerbocker Ice Co. stable was a three-story building constructed so that the second and third floors were suspended from the roof, thereby leaving no columns to obstruct the main floor. The roof trusses spanned about sixty feet and were correspondingly heavy.

Item 65, the Oak Park Hospital was a strictly fire-proof structure composed of cast iron columns and steel floor beams. The roof was a hip and valley roof made up of channels, beams and tee iron, which in turn were covered with tile.

Item 66, the Otis Elevator Co. Foundry building was constructed on the common mill building plan with riveted steel columns, trusses, crane runway, purlins and bracing, which needs no further description.

Item 72, the Garrett Biblical Institute Annex, while a small building containing only 39 tons of structural steel, has a complicated hip roof with dormer windows. The entire roof was covered with 1½x1½x ¼ in. angles, all fitting around the dormer rooms for Ludowici tile.

Item 76, the St. Stanislaus Hall building consisted mostly of large plate girders and high A-shaped trusses.

Item 77, the Gould Elevator is a large grain elevator with reinforced brick sides and steel hopper bottoms. The hoppers were made of 5-16 in. steel plates and were supported by heavy plate girders, which in turn rested on the exterior masonry wall and on interior steel columns. The plates for these hoppers, some of which were sixteen feet square when assembled, were all shipped loose and assembled at the building.

Item 78, the Alling Construction Co. tank support was of the ordinary four post construction. The posts were made of beams and had a slight batter. The bracing was composed of angles.

Items 80 and 85, the Fred Miller Brewing Co. stock house and bottling house were both constructed with very heavy floor systems and cast iron columns. The buildings were square and required few details, as most of the floor beams were alike.

Item 81, the Western Foundry Co. building was mostly roof-truss work consisting of 120-ft. trusses resting on masonry walls with a cast-iron column in the center. Suspended from these trusses was a beam trolley-track with a number of curves and switches, which made the detailing more expensive than it would have been for ordinary roof truss work.

There is always a noticeable decrease in the cost of details when the plans for the iron work are made and designed by an engineer and separated from the general plans. On comparing the cost of picking out the structural steel and making the shop drawings from the architect's plans and the engineer's plans, it was found that the cost of the former is on an average of 35 per cent higher than the latter. Where the engineer's plans are made with no dimensions, with only the outline and sections given, it being necessary to refer to the general plans for the location and dimensions there is no saving of time, and the detailing runs as high as on the architect's plans.

Inaccurate plans, where the draftsman is continually finding errors, cause an increase in the cost, as it is necessary to wait and refer the matter to the architect; and in most cases he, in turn, has to check over his plans before he can settle the question, all of which causes considerable delay and takes time that might otherwise be spent in making the drawings.

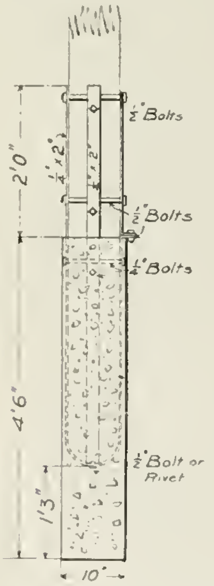
The cost of structural steel details depends on so many things that it is hard to set any fixed rule for determining what this cost is. The type of the building is the first consideration; then the architect and engineer, their methods of drawing up their plans; and finally the detailing drafting force one is obliged to depend upon.

Cost of Making and Setting Concrete Bases for Wood Poles.

The accompanying drawing shows a concrete base for transmission line poles invented by Mr. M. H. Murray of Bakersfield, Cal., and used by the Power Transit & Light Co. of that city. There bases are molded and shipped to the work ready for placing. They weigh about 420 lbs. each. One base requires 37½ lbs. of 2x¼ in. steel bar, 40 lbs. of Portland cement, 3 cu. ft. of broken stone or gravel and enough sand to fill the form or mold, which is 10x10 ins. by 4½ ft. Unskilled labor is employed in the molding and two men can mold ten bases per 8-hour day. The cost of molding is as follows per base:

2 men at $2 per day	$0.40
Brace irons per set	2.50
1/9 cu. yd. stone at $4.05	0.45
40 lbs. cement at 1½cts.	0.60
Sand	0.15
Total cost	$4.10

In the work for the company named above two men at $2 per day each set five bases in eight hours, making the cost of setting 80 cts. per base. The bases were sunk to a depth of 3 ft. 3 ins. In many cases they were placed under poles without interrupting service by sawing off the pole, dropping it into the ground, placing the new base and setting the sawed-off pole on it and bolting up the straps.



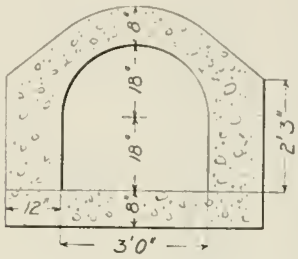
Concrete Base for Wooden Poles.

The Chilean government has purchased 25 heavy American locomotives to be used on the heavier grading of the State railways.

The State Legislature of Connecticut has adopted a program providing for the expenditure of $750,000 a year on good roads.

The Cost of Small Concrete Culverts.

Experiments have been made by a number of railway companies in substituting concrete for cast iron pipe culverts for small openings. Mr. Alex. R. Holliday gives the following figures of cost of such small concrete culvert work carried out under his direction. The culvert section used is shown in the accompanying cut. As will be seen, this section gives a slightly longer waterway than a 36-inch cast iron pipe. Eight culverts, having an aggregate length of 306 ft. were built, using a mixture of Portland cement and limestone and screenings. Each culvert had a small spandrel wall at each end.



Section of Small Concrete Culvert.

The work was done by a gang of six men, receiving the following wages:

Foreman, cents per hour	27.5
Assistant	17.5
Laborers	15.0
Teams	35.0

The materials were hauled about 1 mile from railway to site of work. Cement, including freight and haulage, cost $1.97 per barrel. Limestone and screenings cost 50c per cu. yd f. o. b. at quarry. No freight charges are included in cost of any of the materials except cement. The cost of the 306 ft. of culvert was as follows:

Item.	Total.	Per lin. ft.	Per cu. yd
Labor	$443.14	$1.45	$3.35
Stone and screenings	78.50	0.25	0.60
Cement	307.53	1.01	2.34
Forms	12.00	0.04	0.09
Total	$841.17	$2.75	$6.38

The total length of the railways of the world on Jan. 1, 1906, is declared to have been 563,771.7 miles, of which the United States represents 215,713.39 miles and Europe 192,247.52 miles, resulting in an American lead of about 23,500 miles over Europe. The total mileage on the American continent is estimated to be more than one-half of that of the entire world. Railway construction during 1905 added 12,524.33 miles to the world's total mileage, 2,485.48 of which were in Europe alone, where Germany shows the comparatively largest increase—six times in excess of that of Great Britain. Considerable progress is now being achieved in the building of additional railways connecting German-African cotton and mining districts in the interior of Africa with the seacoast.

Hints on Handling Wheeled Scrapers.

Although the wheeled scraper is one of our most common excavating tools, it is not an easy task to manage a piece of work upon which wheelers are operated. Numerous details must be given constant attention, and one of a number of oversights or accidents can tie up the whole outfit for some minutes, a repetition of which amounts to a considerable money loss.

A contractor can decide upon the method of handling his scrapers, but the actual management of the operation rests with the foreman, and, speaking from a broad experience, it can be stated that capable scraper foremen are difficult to obtain. The reason is not that ordinary foremen lack intelligence, but that they think the handling of scrapers so easy that they are inclined to let things run themselves, instead of making a study of their work and using their wits to manage their crew and scrapers so as to increase the amount of earth excavated daily.

In operating scrapers the first consideration is the plowing of the material. This seems a simple matter, consequently it is seldom done properly. If the earth to be excavated will allow it, the plow should be set to cut a furrow from ten to twelve inches deep. With such a depth of well broken up dirt the scraper will be heaping full after traveling but a few feet, but if the material is not broken up well and is not plowed deep, the scraper will travel some distance over the ground without getting even a good load, for the back half of the pan will not heap itself with dirt unless the loading of the scraper is done quickly and with some snap.

The furrows should be kept close together and care exercised that ridges of unplowed ground are not left between them, else the work of loading will be impeded. It is also important that the bottom of the cut should be kept level so that the scraper pan will lie flat and not be tilted to one side, thus taking a load the greater part of which will drop off on the way to the dump. It will frequently pay in stiff, heavy soils to plow the material twice, as this class of earth can be broken up in this manner so as to load the scrapers much faster and easier.

Wheeled scrapers are generally made in four sizes, No. 1 being the smallest. This size is not used very extensively, because most dirt movers do not seem to appreciate their value. A snatch or snap team is not needed in operating this size scraper. One man also can load it, and two horses can pull it up an incline as easily as a drag. These facts make it as cheap to operate as a drag or slip scraper, and it carries a larger load than the largest size of the drags. The load, too, can be carried farther. This makes the unit cost of excavation much lower. For short hauls, with loads of 75 to 200 feet, a No. 1 wheeler is not only superior to a drag, but also to a larger size wheeled scraper. Every dirt moving contractor should have some of this size wheelers in his outfit, just as he keeps on hand some drags.

Farmers in many sections of the country have learned the value of owning some scrapers for doing various work on their farms, and they have bought drag scrapers for their use. Manufacturers would do well to instruct their sales agents to show purchasers the merits of No. 1 wheelers. It would mean larger sales for themselves and a substantial saving to their customers.

In operating Nos. 2, 2½ and 3 wheeled scrapers, a snatch team is necessary to help load the scraper. Most contractors have found that in average earth, or those heavier than average, three horses in the snatch team are better than two. Two horses only working well where the soils are light. The three-horse snatch team has become the usual one in most sections. Good results are obtained with it, but much better and more economical work can be done with a four-horse snatch teach. Two men are generally used with a snatch team, one to hook and unhook the team to the scraper, and the other to do the driving. With four horses the same number of men are needed. The horses are hitched up in pairs. Four horses will load the scrapers not only quicker, but with a larger load. Their greatest value is in changing from one end of the cut to the other. When loading the scraper team should always pull in the direction in which the load is to be hauled. By doing this the load is kept in the pan better, for in turning a loaded wheeler on the plowed ground much earth is spilled. Then, too, in narrow cuts the loaded team does not interfere with the empties, which can pass behind the snatch team, turn around, lower the pan in position for loading and pull up behind the snatch team at the proper moment. In plowing, the two extreme ends of the row are never plowed as deep or as well as the rest of the row. Consequently in loading there is less dirt to be picked up at the ends, so the work is lighter and easier.

With a three-horse snatch team, the snatch team must be used until the last scraper is loaded at the end of the row, then time is lost by all the wheelers, while the snatch team is traveling the length of the cut to start another row. This generally means that the run of the scrapers is interfered with and one team blocks another, so that even with close attention on the part of the foreman it may be some minutes before the teams are again spaced out and moving with clocklike precision.

With a four-horse snatch team, however, this loss of time and confusion can be prevented. As the scrapers near the end of the row, and there are not two or three more loads of dirt to be picked up, two horses from the snatch team are sent to the other end of the cut and while one part of the snatch team is finishing up the old row the other part is starting a new row. The light plowing at the ends of the row makes this a quick job, and as the scrapers get into the heavy plowing of the new row, the snatch teams have been made into one again, and the work is carried on without a break. The saving effected with a four-horse snatch team over a three-horse will generally pay for the extra horse many times over.

For most wheeled scraper work, Nos. 2 and 2½ are the best sizes to use. Contractors have adopted them for railroad, levee, wagon road, reservoir and other construction. The No. 3 is too heavy, and drags on the horses, especially in sandy or light loam. They are also too hard on a team in loading or in mounting an incline. In some special places they can be used to excellent advantage. When the load is over a good hard roadway, and the excavation is on slightly higher ground than the dump, a No. 3 is no harder on the team and is more economical than the other sizes.

In dumping a scraper one man can manipulate the scraper if the team is kept moving at a slow gait. Some contractors however, use two men on their dumps. With but little practice a dump man can learn how to hold the pan after he has tilted it, so as to spread and level off each load as it is dumped. This is much easier to do when the load is dumped over the end of an embankment, but when dumping on a level place the dirt can be distributed in from 3 to 6 inch layers without additional work.

Scrapers are worked in "runs" according to the length of the "haul." It must be remembered that the "lead" is considered as being from the center of mass of the cut to the center of mass of the dump. The "haul" is the entire distance traveled by the scraper to and from the dump, and is always more than twice the length of the lead, as it includes the distance traveled in turning the team, and when the cut is deep and nearly completed it may mean going to the far end of the cut in order to allow the scraper to enter it. There should always be enough scrapers in a "run" to keep the loaders and the snatch team steadily at work.

Scraper work is ideal when the lead is from 300 to 400 ft, and good work can be done up to 500 to 600 ft., but the cost quickly increases when the distance becomes greater. For this reason an extra price is needed when the leads are long. The extra price paid is termed the "overhaul price," and when it applies to scraper work the free haul should not exceed 500 ft. Overhauling is a labyrinth in which many contractors become lost, and we will reserve that subject for a future issue.

Cost of Digging Post Holes for a Fence.

In building the levees along the Mississippi river to retain the waters within its banks, fences are erected on both the land and river side. The price paid for this work is included in that for excavation. We are able to give the detail costs of some of the work.

The fences are built with posts 5 in. square, 7½ ft. long, 2½ ft. being in the ground. These posts are of oak, mulberry, black locust or sassafras, cut in the local timber lands. They are spaced 12 ft. apart. Four galvanized barbed wires are stretched and attached to the posts.

Along the Mississippi at present foremen are paid $100 per month and board, while laborers are receiving $1.75 for a 12-hour day. The materials and labor give a cost of a single line of fence per mile of $125, which is quite low.

The post holes are dug on the post hole augers, the holes being 6 in. in diameter and 2½ ft. deep. In the soil that occurs along the river, one man with a 6-in. auger, working 12 hrs., will dig on an average 100 holes. This means a cost of 1¾ cents for labor for digging a hole, and as there are 440 holes to a mile of fence it means the cost of digging the holes per mile will aggregate $7.70.

From each hole is excavated ½ cu. ft. of earth, and with a 6-in. auger digging to a depth of 2½ ft. the cost of excavating a cubic yard of earth is 94½ cts.

Assuming that for a 10-hour day a man would do proportionally the same amount of work, with wages at $1.50 per diem, we then have 84 holes dug in a day, making a cost of 1.8 cts. per hole, and cost per mile of $7.92. With the national government enforcing the 8-hour law on the levee construction that is to be done under United States engineers, the number of holes dug a day will be decreased to 67. Should wages for a 8-hr. day be the same as contractors are now paying for a 12-hr. day on contracts they have from the state boards, the cost per hole would be 2.6 cts., and the cost of digging holes per mile of fence would become $11.44.

Driving Steel Piling.—A Star drilling machine was used in driving steel sheet piling through water-bearing sand and gravel for a mine shaft. Several attempts had previously been made to sink a shaft by means of a steel shoe and jackscrews, but all had failed owing to the caving in of the sand and gravel. It was then decided to use steel sheet piling. The shaft was made 9x16 ft. in the clear and was sunk in the usual way through 50 ft. of surface clay and about 10 ft. into the sand and gravel. Here the using of interlocking steel sheet piling was commenced, and the piles were driven to a depth of 20 ft. Each 20-ft. pile was composed of one 10-ft. piece and two 5-ft. pieces, the latter being used in order to allow the pile driving machine to get under the braces at the head frame of the shaft. The long and short sections of adjacent piles broke joints with each other, and the joints in each pile were spliced with plates bolted on, a band of copper being fitted between the ends of the sections. At the surface was the Star drilling machine, handling a 1,600-lb. hammer by means of a jerk line and giving it a drop of about 3 ft. The hammer was guided by a system of sheaves and directed over the piling by a large piece of heavy sheet steel pipe. At the bottom the piles penetrated into the slate rock making a tight joint, and when all of them had been driven a caisson was formed. The excavation of sand was then commenced, the shaft being timbered as the work progressed. When rock was reached the shaft was sunk through it in the usual way.

Consul Alexander Heingartner of Riga advises that the credits having been granted, the Russian ministry of ways and communication has instructed to M. S. J. Maxinovitch, an engineer attached to that department, the work of preparing a plan for the construction of a canal to connect the Baltic with the Black Sea. The present position of this project, as given by the department's official organ, is as follows: The original plans of the waterway Riga-Cherson having been found inadequate, the ministry of ways of communication has prepared a new project which should confer the benefits of a canal and at the same time utilize the energy contained in the falls of the western Dwina and Dnieper for the generation of electric power, such power being estimated at 220,000 HP., with a local value of 50 to 100 rubles (ruble equals 51.5 cts.) per horsepower per annum. The following are the main features of the scheme: First, the depth of the waterway to be sufficient for the passage of vessels of a carrying capacity of not over 55,000 poods (900 tons) or 60 to 70 cars. Second, a system of locks on the Western Dwina, beginning at the island of Dahlen, near Riga, to the town of Vitebsk, a distance of 540 versts (350 miles). Third, a canal to join the two rivers—Western Dwina and Dnieper—starting from the town of Vitebsk on the Dwina, to that of Oesha on the Dnieper—86 versts (60 miles). Fourth, a system of locks on the Dnieper from Oesha to its junction with the river Beresina, 384 versts (275 miles). Fifth, for a distance of 102 versts (70 miles) along the unnavigable portion of the Dnieper, a system of stone locks, nine in number. The total length of the waterway is to be about 2,310 versts (1,525 miles), the estimated cost of the work 75,000,000 rubles, and among the many benefits a relief to the chronic congestion on the Southwestern Railroad system, it being estimated that the Dnieper alone is able to further freight during the navigation season to the amount of 180,000,000 poods (2,900,000 tons), or 240,000 cars. The expense in connection with the utilization of the falls of the two rivers for electric purposes is calculated at a further 185,000,000 rubles, so that the estimated outlay on the new project is 260,000,000 rubles, or about $130,000,000.

The William B. Hough Co. of Chicago, Ill. have put on the market a special contractor's engine built in five sizes from 12 to 50 H. P. and having a hoisting capacity of 3,000 to 14,000 lbs. All parts of the engine are made to standard gage under a duplicate part system. This company also announces that its sale of Russian mixers has shown a remarkable increase during the last few months.

According to statistics just published by Lloyd's Register, the merchant fleets of the globe now total 39,438,000 tons, or nearly 2,000,000 more than a year ago. Of this huge total no less than 33,969.00 tons represent steam shipping, and 17,001,000 tons of it is under the British flag.

We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0317. **Flexible Metallic Hose and Tubing.** The New York Flexible Metallic Hose & Tubing Co., New York, N. Y.

The "hose" described in this circular is built up of twisted ribbon-like strips of pliable steel or copper having their edges formed into interlocking lips, the joints of which are packed with asbestos or rubber. For special purposes this "hose" is enclosed in a lead casing and for water pipe it is given a sheet lead lining as well as a casing.

No. 0318. **Dump Wagon Boxes.**—Black Mfg. Co., Chicago, Ill.

This catalog describes and illustrates a portable bottom dump wagon box that can be applied to any wagon with a reach. The claim made for the box is that it is sand tight and distributes the load evenly over the front and rear wheels. By buying these boxes the contractor gets the use of his wagon gears for other purposes when desired and need only own the boxes, renting the gears and teams from local teamsters. The device is an interesting one and contractors will do well to get the catalog and study it.

No. 0319. **Dump Cars.**—Kilbourne & Jacobs Mfg. Co., Columbus, O.

This catalog describes and illustrates the large line of dump cars made by the firm named. Rotary and side dump cars, hopper bottom dump cars, tracklaying, quarry and contractors' cars are all described.

No. 0320. **Scraper Bucket Excavators.**—Page & Shnable, Chicago, Ill.

This is a well arranged description of the construction and operation of the Page scraper bucket which in connection with a derrick forms an excavating machine of unusual economy and simplicity. These excavators have been widely used with good success in both earth and broken rock excavation.

No. 0321. **Crane Controllers.**—The Cutler-Hammer Mfg. Co., Milwaukee, Wis.

This is an excellent example of descriptive catalog work. The several types of controllers for electric cranes are illustrated and described in detail. The reader to whom this class of machine is unfamiliar can get a very good idea of its essential features from the text and drawings of this pamphlet alone.

No. 0322. **Channel Bar Piling.**—National Interlocking Steel Sheeting Co., Chicago, Ill.

The steel piling described in this pamphlet consists of commercial channels which are made interlocking by a movable "lock." When equipped with the lock the channels form a perfectly interlocking sheeting which can be pulled and with the lock removed used as plain channels.

No. 0323. **Cost of Tarviated Streets.**—Barrett Mfg. Co., Chicago, Ill.

This is a reprint of an interesting and valuable paper by Mr. Linn White, Engineer South Park Commission, Chicago, Ill., describing the methods, results and cost of treating park boulevards with Tarvia.

No. 0324. **Clouser Chain Belt.**—Link Chain Belt Co., New York, N. Y.

This pamphlet describes and illustrates the construction and use of the Clouser chain belt for power transmission. This belt is so designed that the separate links can be coupled and uncoupled at will and so that it can be operated as a cross-belt.

No. 0325. **Reinforced Concrete.**—The Ferro-Concrete Construction Co., Cincinnati, O.

This pamphlet illustrates a number of bins, tanks, buildings, stand pipes, foundations constructed by the above company of reinforced concrete.

No. 0326. **Automatic Hose Couplings.**—Thos. H. Dallitt Co., Philadelphia, Pa.

This circular describes a new form of automatic hose coupling which has just been put in the market by the company named.

No. 0327. **Hod and Wheelbarrow Elevators.**—Conrad Carlson, Brooklyn, N. Y.

This pamphlet illustrates and describes a full line of hod and wheelbarrow elevators, hoisting engines, winches, etc., for building construction.

No. 0328. **Gas Engines.**—Weber Gas Engine Co., Kansas City, Mo.

This is an excellently illustrated and well written descriptive catalog of the Weber gas engine, one of the oldest and best known of gas engines. All parts of the engine are described and illustrated. There are also descriptions and illustrations of the Weber suction gas producer.

CONTRACT NEWS

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BIDS ASKED.

Bridges.

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Aug. 31.	Greenfield, Mass	Aug. 28
Aug. 31.	Jasper, Ind	Aug. 28
Sept. 1.	Natchez, Miss	Aug. 28
Sept. 2.	Sandpoint, Ida	Aug. 28
Sept. 2.	St. Clairsville, O	Aug. 28
Sept. 2.	Trenton, O	Aug. 28
Sept. 2.	Elkhart, Ind	Aug. 28
Sept. 2.	Danville, Ind	Aug. 28
Sept. 2.	Washington, Ind	Aug. 28
Sept. 2.	Tipton, Ind	Aug. 28
Sept. 2.	Franklin, Ind	Aug. 28
Sept. 2.	Boonville, Ind	Aug. 28
Sept. 2.	Tarboro, N. C	July 31
Sept. 2.	Ashtabula, O.	Aug. 21
Sept. 2.	Jefferson, O.	Aug. 21
Sept. 3.	Ingot, Cal.	Aug. 21
Sept. 3.	Catlettsburg, Ky.	Aug. 21
Sept. 3.	Natchez, Miss.	Aug. 21
Sept. 3.	Anderson, Cal	Aug. 28
Sept. 3.	Sedalia, Colo	Aug. 28
Sept. 3.	Crown Point, Ind	Aug. 28
Sept. 3.	Monticello, Ind	Aug. 28
Sept. 3.	Bloomfield, Ind	Aug. 28
Sept. 3.	Santa Barbara, Cal	Aug. 28
Sept. 3.	San Jose, Cal	Aug. 28
Sept. 4.	Rahway, N. J	Aug. 28
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Sept. 4.	Winnipeg, Man	Aug. 28
Sept. 4.	Glasgow, Mont	July 31
Sept. 4.	Columbus, O.	Aug. 21
Sept. 5.	Eaton, O	Aug. 28
Sept. 9.	Wichita, Kan	Aug. 28
Sept. 9.	Laurel Springs	Aug. 28
Sept. 9.	Paquemine, La	Aug. 14
Sept. 10.	Yo Semite, Cal	Aug. 28
Sept. 14.	Cleveland, O	Aug. 28
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Buildings

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Aug. 28.	Anthony, Kan	Aug. 14
Aug. 28.	New York, N. Y	Aug. 21
Aug. 28.	Cleveland, O	Aug. 14
Aug. 28.	Fort Smith, Ark	Aug. 14
Aug. 29.	Peru, Ind	Aug. 14
Aug. 29.	Wahpeton, N. Dak	Aug. 7
Aug. 29.	Iowa City, Ia	Aug. 7
Aug. 29.	Price, Utah	Aug. 21
Aug. 28.	Denmark, S. C	Aug. 28
Aug. 29.	Sherbrooke, Que	Aug. 28
Aug. 29.	New York, N. Y	Aug. 28
Aug. 30.	Mont Alto, Pa	Aug. 28
Aug. 30.	Moscow, Idaho	Aug. 14
Aug. 31.	Egeland, N. D.	Aug. 21
Aug. 31.	Athens, O.	Aug. 21
Aug. 31.	Mansfield, O.	Aug. 21
Aug. 31.	Stendel, Ind	Aug. 28
Sept. 2.	Sledell, La	Aug. 28
Sept. 2.	Elkhart, Ind.	Aug. 21
Sept. 3.	New Fort Lyon, Colo	Aug. 21
Sept. 3.	Cleveland, O	Aug. 14
Sept. 3.	Watertown, N. Y	July 31
Sept. 3.	Bloomfield, Ind	July 31
Sept. 3.	Anthon, Ia.	Aug. 21
Sept. 3.	Washington, D. C	Aug. 7
Sept. 3.	Bloomfield, Ind.	Aug. 7
Sept. 3.	St. George, S. C	Aug. 21
Sept. 3.	Fishers Switch, Ind	Aug. 28
Sept. 3.	Wyandotte, I. T	Aug. 28
Sept. 3.	Buffalo, N. Y	Aug. 28
Sept. 4.	New London, Conn	Aug. 28
Sept. 4.	Albany, N. Y	Aug. 28
Sept. 4.	Quincy, Mass	July 31
Sept. 5.	Evansville, Ind.	Aug. 7
Sept. 5.	Columbia, S. C	Aug. 28
Sept. 5.	Geneva, N. Y	Aug. 28
Sept. 9.	Cleveland, O.	Aug. 21
Sept. 10.	Shreveport, La	Aug. 28
Sept. 10.	Whitesboro, N. Y	Aug. 28
Sept. 11.	Eureka, Cal	Aug. 14
Sept. 12.	Marianna, Fla	Aug. 28
Sept. 12.	Rome, N. Y	Aug. 28
Sept. 14.	Hudson, N. Y	Aug. 28
Sept. 16.	Washington, D. C	Aug. 28
Sept. 16.	Pittsburg, Pa.	Aug. 7
Sept. 16.	Buffalo, N. Y	Aug. 7
Sept. 17.	Lawrence, Kan	Aug. 28
Sept. 17.	San Francisco, Cal	Aug. 14
Sept. 19.	Muscatine, Ia	Aug. 14
Sept. 23.	Cedar Rapids, Ia	Aug. 14
Sept. 24.	Hamilton, O.	Aug. 21
Sept. 30.	Selma, Ala	Aug. 28
Oct. 1.	Eau Claire, Wis	Aug. 28
Oct. 1.	Pensacola, Fla.	Aug. 21
Oct. 7.	Baltimore, Md	Aug. 28

Roads and Streets.

Aug. 28.	Hoboken, N. J	Aug. 14
Aug. 28.	Hoboken, N. J	Aug. 7
Aug. 28.	Hoboken, N. J	July 31
Aug. 28.	Fort Lee, N. J	Aug. 7
Aug. 28.	Baltimore, Md	Aug. 28
Aug. 29.	New York, N. Y	Aug. 28
Aug. 29.	Cincinnati, O	Aug. 28
Aug. 29.	Kansas City, Mo	Aug. 28
Aug. 29.	Kansas City, Mo	Aug. 28
Aug. 29.	Kansas City, Mo	Aug. 28
Aug. 29.	Kansas City, Mo	Aug. 28
Aug. 29.	Smithport, Pa	Aug. 14
Aug. 30.	Tipton, Ind	Aug. 14
Aug. 30.	Marshfield, Mo	Aug. 14
Aug. 30.	Cincinnati, O.	Aug. 7
Aug. 30.	Marshfield, Mo	July 31
Aug. 30.	Rutherford, N. J	Aug. 28
Aug. 30.	Rutherford, N. J	Aug. 28
Aug. 30.	Rutherford, N. J	Aug. 28
Aug. 30.	Rutherford, N. J	Aug. 28
Aug. 30.	Woodsfield, O	Aug. 28
Aug. 30.	Richmond, Ind	Aug. 28
Aug. 30.	Muncie, Ind	Aug. 28
Aug. 31.	Ridgway, Pa.	Aug. 21
Aug. 31.	Greencastle, Ind.	Aug. 21
Sept. 2.	Sullivan, Ind.	Aug. 21
Sept. 2.	Salem, Ind.	Aug. 21
Sept. 2.	Fond du Lac, Wis	Aug. 28
Sept. 2.	Jamestown, N. Y	Aug. 28
Sept. 2.	English, Ind.	Aug. 28
Sept. 2.	Winnemac, Ind	Aug. 28
Sept. 3.	Covington, Ind	Aug. 28
Sept. 3.	Canton, O	Aug. 28
Sept. 3.	Jacksboro, Tenn	Aug. 28
Sept. 3.	Wilmington, Del	Aug. 28
Sept. 3.	Monticello, Ind	Aug. 28
Sept. 3.	St. Bernard, O	Aug. 28
Sept. 3.	Lake Charles, La	Aug. 28
Sept. 3.	Snow Hill, Md	Aug. 28
Sept. 3.	Bloomfield, Ind	Aug. 28
Sept. 3.	Beardstown, Ill	Aug. 14
Sept. 3-4-5.	Albany, N. Y	Aug. 14
Sept. 3.	New Philadelphia, O	Aug. 7
Sept. 3.	Yorktown, Va.	Aug. 7
Sept. 3.	Indianapolis, Ind.	Aug. 21
Sept. 4.	Bloomington, Ind	Aug. 28
Sept. 4.	Providence, R. I	Aug. 28
Sept. 4.	Elmira, N. Y	Aug. 28
Sept. 4.	New York, N. Y	Aug. 28
Sept. 4.	Providence, R. I	Aug. 28
Sept. 5.	Carrollton, O	Aug. 28
Sept. 6.	Decatur, Ind	Aug. 28
Sept. 11.	Bridgeton, N. J	Aug. 28
Sept. 11.	Cincinnati, O	Aug. 28
Sept. 11.	Cleveland, O.	Aug. 21
Sept. 11.	Cleveland, O.	Aug. 21
Sept. 12.	Cincinnati, O	Aug. 28
Sept. 13.	Des Moines, Ia	Aug. 28
Sept. 13.	Madison, Wis	Aug. 28
Sept. 14.	St. Moultrie, S. C	Aug. 28
Sept. 20.	Rockville, Ind	Aug. 28

Sewers.

Aug. 28.	Louisville, Ky	Aug. 14
Aug. 28.	New York, N. Y	Aug. 28
Aug. 29.	New York, N. Y	Aug. 28
Aug. 29.	Akron, O	Aug. 28
Aug. 30.	Milwaukee, Wis	Aug. 28
Aug. 30.	Youngstown, O	Aug. 28
Aug. 30.	Norfolk, Neb	Aug. 28
Aug. 30.	Richmond, Ind	Aug. 28
Aug. 30.	Fort Dade, Fla	Aug. 14
Aug. 30.	Evansville, Ind	July 24
Aug. 31.	Canal Dover, O	Aug. 14
Aug. 31.	Elroy, Wis	Aug. 14
Sept. 2.	Columbus, O.	Aug. 21
Sept. 2.	Grand Rapids, N. D	Aug. 28
Sept. 2.	Riverside, N. J	Aug. 28
Sept. 3.	Alexandria, La	Aug. 28
Sept. 3.	Canton, O	Aug. 28
Sept. 3.	Kingston, N. Y	Aug. 28
Sept. 3.	New Ulm, Minn.	Aug. 21
Sept. 4.	Beloit, Wis	Aug. 28
Sept. 5.	Sumter, S. C	Aug. 28
Sept. 5.	Monessen, Pa.	Aug. 21
Sept. 6.	Iowa City, Ia	Aug. 7
Sept. 9.	Bryant, S. D	Aug. 28
Sept. 11.	New Orleans, La	July 10
Sept. 13.	Des Moines, Ia	Aug. 28
Sept. 13.	Lake Mills, Wis.	Aug. 21

Water Supply.

Aug. 28.	Decatur, Ill	Aug. 28
Aug. 28.	New York, N. Y	Aug. 28
Aug. 29.	Philadelphia, Pa	Aug. 14
Aug. 30.	Fort Dade, Fla	Aug. 14
Aug. 30.	Norfolk, Neb	Aug. 28
Aug. 31.	Grosse Pointe Farms, Mich.	Aug. 28
Aug. 31.	Chicago, Ill	Aug. 14
Aug. 31.	Chicago, Ill	Aug. 14
Aug. 31.	Chicago, Ill	Aug. 14
Aug. 31.	Montgomery, Minn.	Aug. 21
Sept. 2.	Carrington, N. Dak	Aug. 7
Sept. 3.	Kansas City, Mo	Aug. 14
Sept. 3.	Victoria, B. C	Aug. 14
Sept. 4.	New Orleans, La.	July 3
Sept. 5.	Bellevue, O	Aug. 28
Sept. 6.	Montreal, Que	Aug. 14
Sept. 7.	Pensacola, Fla.	Aug. 21
Sept. 9.	Orange, N. J	Aug. 28
Sept. 14.	Norfolk, Va.	Aug. 21

Miscellaneous.

Aug. 28.	Wilmington, Del., Jetty,	Aug. 28
Aug. 28.	Skaneateles, N. Y., Protection Walls,	Aug. 28
Aug. 29.	Paulsboro, N. J., Gas Plant,	Aug. 28
Aug. 29.	New York, N. Y., Fence,	Aug. 28
Aug. 29.	New York, N. Y., Pier Structures,	Aug. 28
Aug. 29.	Fort Lawton., Wash, Corrals,	Aug. 14
Aug. 30.	Philadelphia, Pa., Suction Dredges,	Aug. 7
Aug. 30.	New York, N. Y., Iron Flagstaff,	Aug. 21
Aug. 30.	New Orleans, La., Seawall,	Aug. 28
Aug. 31.	Galveston, Tex., Jetty Work,	Aug. 7
Aug. 31.	Lebanon, Pa., Street Lighting,	July 24
Aug. 31.	Rushville, Ind., Crushed Stone and Gravel,	Aug. 21
Sept. 1,	Webb City, Mo., Railroad,	July 31
Sept. 2.	New York, N. Y., Rubble Stone, Dikes,	Aug. 21
Sept. 3.	Winnipeg, Man., Hydro-Electric Development,	June 19
Sept. 3.	Two Rivers, Wis., Pier Work,	Aug. 14
Sept. 3.	Joliet, Ill.	Aug. 21

Sept. 3. L'Anse, Mich., Hydraulic Power Plant, Aug. 28
Sept. 4. Baltimore, Md., Disposition of Garbage, Aug. 21
Sept. 9. West Point, N. Y., Emplacements, Aug. 28
Sept. 10. Philadelphia, Pa., Lighthouse Superstructure, Aug. 28
Sept. 10. Fairport, O., Breakwater, Aug. 14
Sept. 10. Cleveland, O., Breakwater, Aug. 14
Sept. 10. Bar Harbor, Me., Breakwater, Aug. 21
Sept. 11. Cincinnati, O., Dike and Dam, Aug. 21
Sept. 12. Millen, G. A., Electric Light and Water Plant, Aug. 28
Sept. 16. Stockton, Cal., Bulkhead, Aug. 28
Sept. 30. Washington, D. C., Search Light Outfit, Aug. 7
Oct 5. Franklin Shoals, Ark., Lock and Dam, Aug. 7
Oct. 5. Mobile, Ala., Locks and Dams, Aug. 14
Oct. 5. Franklin., Ark., Aug. 14
Oct. 5. Vicksburg, Miss., Lock and Dam, Aug. 14

Excavation, Earth and Rock.

Aug. 30. Portland, Me., Rock Excavation, Aug. 7
Aug. 31. Sanders (Howard Postoffice), Mont., Ditch Work, Aug. 28
Sept. 2. Tacoma, Wash., Dredging, Aug. 7
Sept. 3. Shawneetown, Ill., Levee Work, Aug. 28
Sept. 3. Ft. Snelling, Minn., Ditch Work, Aug. 14
Sept. 3. Joliet, Ill., Excavation, Concrete Walls, Aug. 21
Sept. 4. Providence R. I., Dredging, Aug. 7
Sept. 4. Norfolk, Va., Dredging, Aug. 14
Sept. 4. Providence, R. I., Dredging, Aug. 14
Sept. 4. Woonsocket, S. D., Drainage Ditch, Aug. 21
Sept. 5. Seattle, Wash., Dredging, Aug. 14
Sept. 7. Little Rock, Ark., Dredging, Concrete Conduit, Aug. 21
Sept. 7. Washington, D. C., Dredging, Aug. 21
Sept. 7. New London, Conn., Dredging, Aug. 21
Sept. 10, Sibley, Ia., Ditch Work, July 31
Sept. 10. New Orleans, La., Dredging, Aug. 21
Sept. 10. Patton, Cal., Storm Water Channels, Aug. 28
Sept. 11. Bradley, Ark., Levee Work, Aug. 28
Sept. 12, Rich, Ill. Drainage Ditches, Aug. 28
Sept. 14 Moultrieville, S. C., Dredging, Filling In., Aug. 28
Sept 19. Gardner, Me., Dredging, Aug. 28

Materials, Machines, Supplies, Tools Etc

Aug. 29. San Francisco, Cal., Motors, Chain Drives, Etc., Aug. 7
Aug. 29. New York, N. Y, Supplies, Aug. 28
Aug. 30. Panama, C. A., Locomotives, Aug. 28
Sept. 3. Panama, C. A., Engineering Supplies, Aug. 28
Sept. 3. Portland, Me., Engine, Generator, Aug. 28
Sept. 3. Kansas City, Mo., Pipe and Specials, Aug. 7
Sept. 3. Kansas City, Mo., Steel Pipe, Aug. 7
Sept. 3. Puget Sound, Wash., Piles, Timber, Etc., Aug. 14
Sept. 3. Mare Island, Cal., Pipe, Lamps, Valves, Etc., Aug. 14
Sept. 3-10-17, Washington, D. C., Supplies, Aug. 28
Sept. 5. River Falls, Wis., Fire Hose, Aug. 21
Sept. 8, Louisville, Ky., Pumping Engines, July 31
Sept. 14. Manila, P. I., Valves, Gates, July 31
Sept. 14. New York, N. Y., Motor Generator Sets, Aug. 28

BIDS ASKED.

Bridges.

Items Arranged Alphabetically by States.

Adin, Cal.—Bids are asked until 10 a. m., Sept. 16, by the Board of Supervisors, L. S. Smith, Clk., for the construction of a bridge across Ash Creek at Main St.

Anderson, Cal.—Bids are asked until 10 a. m., Sept. 3, by the Board of Supervisors, S. N. Withero, Clk., for repairing bridge across Sacramento River near Anderson.

San Jose, Cal.—Bids are asked by Henry A. Pfister, Clerk, until Sept. 3, for the construction of 2 concrete bridges over Wildcat Creek, one at Allendale Ave. and the other at Fruitvale Ave.

Santa Barbara, Cal.—Bids are asked by C. A. Hunt, until Sept. 3, for the construction of a bridge across the Santa Maria River, also for the construction of a bridge across San Jose Creek and a bridge across the Santa Yuez River.

Sedalia, Colo.—Bids are asked until noon, Sept. 3, by T. W. Jaycox, State Engineer, at Denver, for the construction of a 100-ft. reinforced concrete bridge across Plum Creek, at Sedalia.

Yo Semite, Cal.—Bids are asked until noon, Sept. 10, by Major H. C. Benson, 14th Cavalry, Acting Supt. Yo Semite National Park, Yo Semite, for the construction of steel bridge across Merced River, in Yo Semite Valley.

Sandpoint, Ida.—Bids are asked until 10 a. m., Sept. 2, by the County Commissioners, Ignatz Weil, Clk., for the construction of bridge across Pack River.

Bloomfield, Ind.—Bids are asked by the Commissioners of Greene County until 2 p. m., Sept. 3, for the construction of 3 bridges.

Boonville, Ind.—Bids are asked by the Commissioners of Warwick County until 2 p. m., Sept. 2, for the construction of a steel bridge in Boon Township.

Crown Point, Ind.—Bids are asked until Sept. 3 for the construction of an iron bridge over the Cady Marsh Ditch on the Ross and Tolleston Gravel road in Calumet Township. Charles A. Johnson, Clerk.

Danville, Ind.—Bids are asked until Sept. 2, for the repair of Brazleton Hadley bridge in Guilford township. Alfred S. Lineinger.

Elkhart, Ind.—Bids are asked until Sept. 2, for the following bridges, No. 1—For the construction of a steel bridge across creek south of Middlebury in center of section 15, on the Middlebury and Goshen road. No. 2—For repairs to Clayton bridge in Jackson Township, across Turkey Creek. Steel joists and new plank. No. 3—For the construction of concrete abutments for steel bridge across Dry Run on the Goshen and Fort Wayne road in Benton Township No. 4—For a concrete arch bridge to be constructed across William Long ditch, one mile west and south of Millersburg in Benton Township. No 5—For the construction of concrete arch across Zollinger ditch on the Benton and Syracuse road, Benton Township. No. 6—For the construction of concrete abutments for steel bridge across Dry Run in Benton Township on road one quarter mile west of the Fort Wayne road. No. 7—For paving bridge on Middlebury street, in this city. No. 8—For the construction of concrete abutments for bridge to be moved from ditch near Monroe Bedk's to Swoveland ditch near Milton Weaver's in Jackson Township. No. 9—For the construction of a concrete arch across ditch on public road from Tyson's corners to the north in Olive Township. No. 10—For the construction of concrete arch across Shrock ditch on the Harrison Center road from Harrison Center to Dills school house, Harrison Township. No. 11—For the construction of concrete abutments for steel bridge across Dry Run on road from Solomon Creek church in Benton, Benton Township. No. 12—For the construction of steel bridge across Keyes ditch in Jackson Township. No. 13—For the construction of concrete abutments for steel bridge across Dry Run on road from Kinnison's school house in Benton Township. No. 14—For the construction of steel bridge across Dausman ditch on Dausman road, one quarter mile south of New Paris in Jackson Township. No. 15—For the construction of concrete abutments for steel bridge across Rock Run on Simons road from Goshen east to Township line. Elkhart Township. O. H. Sweitzer.

Franklin, Ind.—Bids are asked by the Commissioners of Johnson County until 10 a. m., Sept. 2, for the construction of 3 bridges.

Jasper, Ind.—Bids are asked by the Commissioners of Du Bois County until 10 a. m., Aug. 31, for the construction of a bridge over the Patoka River.

Monticello, Ind.—Bids are asked by the Commissioners of White County until 12 o'clock noon, Sept. 3, for the construction of 11 new bridges.

Tipton, Ind.—Bids are asked by the Commissioners of Tipton County until 1 p. m., Sept. 2, for the construction of a bridge over Buck Creek.

Washington, Ind.—Bids are asked by the Comissioners of Daviess County until 2 p. m., Sept. 2, for the construction of 3 steel bridges with concrete abutments.

Wichita, Kan.—Bids are asked until noon Sept. 9, by the Board of County Commissioners, E. P. Martin, Chmn., for the construction of a reinforced concrete bridge across Arkansas River at Douglass Ave., Wichita. George H. Bradford, Wichita, is Engineer.

Greenfield, Mass.—Bids are asked by the Selectmen of Greenfield, until 2 p. m., Aug. 31, for the construction of a reinforced concrete highway bridge over the Hinsdale Brook on the Green River Road. Advertisement appears elsewhere in Engineering-Contracting.

Natchez, Miss.—Bids are asked until Sept. 1, for moving the iron bridge over Homochitto River on the Kingston and Natchez road. James S Fleming, President.

Vicksburg, Miss.—Bids are asked until noon, Sept. 4, by the Board of County Supervisors, J. D. Laughlin, Clk., and the Board of Aldermen, for constructing a concrete arch bridge over Glass Bayou at Cherry St. and concrete-steel bridge at City Cemetery Road, near Rigby Place. H. J. Trowbridge is City Clk.

Laurel Springs, N. J.—Bids are asked until 11 a. m., Sept. 9, for building a new iron truss bridge over Laurel Lake, 64 ft. in length. Fred W. George, Court House, Camden, is Clerk. J. J. Albertson is County Engineer.

Rahway, N. J.—Bids are asked until 3 p. m., Sept. 4, for constructing a reinforced concrete bridge over the Robinson Branch of the Rahway River at New Church St. The bridge is 46 ft. wide with 60-ft. span. J. L. Bauer, 215 Broad St., Elizabeth, is County Engineer.

Cleveland, O.—Bids are asked until 11 a. m., Sept. 14, by the Board of County Commissioners, Julius C. Dorn, Clk., for constructing concrete steel bridge in Strongsville Township.

Eaton, O.—Bids are asked until noon, Sept. 5, by C. W. Eidson, County Audr., for the construction of superstructures of various bridges. Fred. C. Roberts is Engineer.

St. Clairsville, O.—Bids are asked until 1 p. m., Sept. 2, by A. W. Beatty, County Audr., for the construction of substructures and superstructures for various bridges.

Trenton, O.—Bids are asked until Sept. 2 by the County Commissioners at New Philadelphia, for the construction of steel bridge across Ohio Canal at Trenton. The bridge will have 72-ft. span, concrete floor and will be 12 feet in width.

Winnipeg, Man.—Bids are asked until noon, Sept. 4, by Magnus Peterson, Secy. Civic Board of Control, for constructing a wooden Howe truss bridge, consisting of ten spans of 80 ft. each and one draw span of 160 ft.

Buildings.

Items Arranged Alphabetically by States.

Selma, Ala.—Bids are asked until 3 p. m., Sept. 30, for constructing (including plumbing, gas piping, heating apparatus, electric conduits and wiring) the U. S. Post Office at Selma. James Knox Taylor, Treasury Dept., Washington, D. C., is Supervising Architect.

New London, Conn.—Bids are asked until 10 a. m., Sept. 4, for repairs and improvements to buildings belonging to the Marine Corps, Naval Station, New London. James Sweeney is architect, 80 State St., New London. Col. F. L. Denny, Q. M.

Washington, D. C.—Bids are asked by Spencer Cosby, Major Engineers, U. S., Engineer Office, Twenty-second and K sts., N. W., Washington, until noon Sept. 16, for the construction of a machine shop building at the Washington Filtration plant.

Marianna, Fla.—Bids are asked by the Town Council until Sept. 12, for the erection of a $20,000 high school building. J. C. Folsom, Building Commissioner.

Fisher's Switch, Ind.—Bids are asked by the undersigned until Sept. 3, for the furnishing of all materials and installing of a steam heating plant and the erection of a six-room brick school building at this city. Charles Randall, trustee.

Stendel, Ind.—Bids are asked by the Trustees of Lockhart Township, Pilse county, at Stendel, until 2 p. m., Aug. 31, for the construction of a school house.

Wyandotte, I. T.—Bids are asked by the Commissioner of Indian Affairs, Dept. of the Interior, Washington, D. C., until 2 p. m., Sept. 3, for furnishing and delivering the necessary material and labor to construct and complete a frame laundry building at the Seneca School, I. T.

Lawrence, Kan.—Bids are asked by the Regents of the University of Kansas until 11 a. m., Sept. 17, for the erection of an engineering building on the campus of the University at Lawrence.

Shreveport, La.—Bids are asked by the undersigned until Sept. 10, for furnishing all material and labor for the completion of the Elks' club building. H. G. Snyder.

Slidell, La.—Bids are asked by the Board of Trustees, Slidell Public School, until Sept. 2, for the erection of a public school building in this city.

Baltimore, Md.—Bids are asked by Jas. Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Oct. 7, for the construction and mechanical equipment, except plumbing, of an extension to the U. S. Postoffice, Court House, etc., at Baltimore. Plans and specifications may be had at the office of the Custodian, Baltimore, or at the office of the Supervising Architect.

Albany, N. Y.—Bids are asked until 3 p. m., Sept. 4, by the State Commission in Lunacy, Capitol, Albany, N. Y., for construction, heating, plumbing and electric wiring of tuberculosis pavilion at the Willard State Hospital, Willard, N. Y. Also on the same date, for the work of construction, heating, plumbing and electric wiring of dining-room and kitchen addition to chronic building at the Binghamton State Hospital, Binghamton, N. Y. T. E. McGarr is secretary of the State Commission in Lunacy.

Buffalo, N. Y.—Bids are asked until 10 a. m., Sept. 3, by Henry P. Fink, Clerk Board of Supervisors of Erie County, 36 City and County Hall, for building an addition and making alterations at the Erie County jail.

Geneva, N. Y.—Bids are asked by Lyman P. Haviland, Chmn., Building Committee, N. Y. Agricultural Experiment Station, Geneva, until 10 a. m., Sept. 5, for construction, heating, plumbing, electric work and gas piping for three staff residences and two cottages for laborers.

Hudson, N. Y.—Bids are asked by Chas. H. Strong, Pres., Board of Managers, N. Y. State Training School for Girls, Hudson, until 1 p. m., Sept. 14, for construction, heating, plumbing and electric work for three new cottages and alterations to Industrial Building.

New York, N. Y.—Bids are asked by Moses Herrman, Pres. of the Park Board, Borough of Manhattan, until 3 p. m., Aug. 29, for the erection of a shelter house in New Lots Park, one in Fulton Park, one in Winthrop Park and another in Prospect Park. All located in the Borough of Brooklyn.

New York, N. Y.—Bids are asked until 2:30 p. m., Sept. 4, by Robert W. Hebberd, Commissioner, Public Charities, for providing all labor and materials required for erecting and completing (with the exception of fitting up) of a new pathological building at the Kings County Hospital, Borough of Brooklyn.

Rome, N. Y.—Bids are asked by James Knox Taylor, Supervising Architect, Washington, D. C., until 3 p. m., Sept. 12, for construction of the approaches at the U. S. Postoffice, Rome. Plans and specifications may be had of the Custodian, Rome, N. Y., or of the Supervising Architect, Washington.

Whitesboro, N. Y.—Bids are asked until Sept. 10 for the erection complete of a fire department building in this city. W. C. Aldridge.

Mont Alto, Pa.—Bids are asked by Robert S. Conklin, Commissioner of Forestry, Harrisburg, until 2 p. m., Aug. 30, for the erection of a dormitory building at the State Forest Academy, Mont Alto.

Columbia, S. C.—Bids are asked until Sept. 5, by W. D. Starling, Supervisor, for additions, alterations and roofing the court house. Shand & La Faye, 1328 Main St., are Architects.

Denmark, S. C.—Bids are asked by J. B. Traywick, until Aug. 28, for the erection of a brick church building.

Eau Claire, Wis.—Bids are asked by Jas. Knox Taylor, supervising architect, Washington, D. C., until 3 p. m. October 1, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the U. S. Court House and Postoffice at Eau Claire.

Sherbrooke, Que.—Bids are asked until Aug. 29, by Fred Gelinas, Secretary Dept. of Public Works, Ottawa, Ont., for the construction of a drill hall at Sherbrooke.

Roads and Streets

Items Arranged Alphabetically by States.

Wilmington, Del.—Bids are asked until Sept. 3, by Francis A. Price, New Castle County State Highway Commissioner, for the construction of macadam road.

Bloomfield, Ind.—Bids are asked by the Board of Commissioners of Greene County, until 2 p. m., Sept. 3, for the construction of gravel and macadamized road in Richland Township.

Bloomington, Ind.—Bids are asked until 2 p. m., Sept. 4, by the County Commissioners, for construction of pike roads Nos. 1, 2, 3 and 4, in Salt Creek Township, aggregating in length, 12,290 ft. Samuel M. Kerr is County Auditor.

Covington, Ind.—Bids are asked until 1:30 p. m., Sept. 3, by the County Commissioners for constructing four stone pikes, aggregating 9½ miles in length and two gravel roads about five miles in length. W. B. La Baw, Veedersburg, is County Supervisor.

Decatur, Ind.—Bids are asked until Sept. 6, by the County Commissioners, for constructing a macadamized road in Monroe Township, and gravel road in Preble Township. C. D. Lewlon is County Auditor.

English, Ind.—Bids are asked by the Board of Commissioners, Crawford County, until 2 p. m., Sept. 2, for the construction of stone or macadamized roads in Sterling Township and certain streets in English, consisting of draining, grading and paving with stone or other road paving material.

Monticello, Ind.—Bids are asked by J. L. Ackerman, County Auditor, until Sept. 3, for grading, draining and paving various roads with stone.

Muncie, Ind.—Bids are asked by the Board of Public Works, until 10 a. m., Aug. 30, for the following public improvements: The improvement of the roadway of High St. from Main St. to Washington St. with sheet asphalt; and also the improvement of the roadway of Walnut St. from Main St. to Washington St. with sheet asphalt; and also the improvement of the roadway of Main St. from Mulberry St. to Madison St. with sheet asphalt; and also the roadway of Adams St. from Mulberry St. east to within two feet of the Ft. W. C. & L. Ry.'s main track in Madison St. with sheet asphalt and brick. J. A. Jackson, City Clerk.

Richmond, Ind.—Bids are asked by the Board of Public Works until 10 a. m., Aug. 30, for the improvement of Northwest Second St., by grading, graveling and macadamizing the roadway and the construction of cement curbs and gutters and cement sidewalks on both sides of the street from Chestnut to Charles Sts., sidewalks to be uniform width of 6 feet.

Rockville, Ind.—Bids are asked until noon, Sept 20, by the County Commissioners of Parke & Fountain Counties, at Rockville, for constructing stone pike 1½ miles in length. W. B. La Baw, Veedersburg, is Surveyor of Fountain County.

Winimac, Ind.—Bids are asked by the Board of Commissioners of Pulaski County, until 12 o'clock noon, Sept. 2, for the improvement of certain roads by draining, grading and graveling. Plans and specifications may be seen at the Auditor's office.

Des Moines, Ia.—Bids are asked by the Board of Public Works, until 11 a. m., Sept. 13, for the following improvements: Curbing with Portland cement and paving with asphalt upon six inches of Portland cement concrete foundation where no foundation now exists, and upon about three inches of Portland cement concrete foundation where foundation now exists, and one inch binder course and one and one-half inch wearing surface, on Library Ave. from the south curb line of Locust St. to the north line of Walnut St. About 1,084 sq. yds. paving, and about 562 lin. ft. of curbing. Work to begin on or before Sept. 20, and to be completed on or before Oct. 25.

Lake Charles, La.—Bids are asked by the City of Lake Charles, until Sept. 3, for the construction of about 15 miles of cement sidewalks and brick or cement curbing. Plans and specifications may be obtained from the City Engineer.

Snow Hill, Md.—Bids are asked by J. E. White, Treas., Worcester County Commissioners, until Sept. 3, for grading and macadamizing 2 miles of road.

Baltimore, Md.—Bids are asked by the City Register, until 11 a. m., Aug. 28, for grading, putting in curb and gutter and paving with macadam Chelsea Terrace from Clifton Ave. to Windsor Mill Road. Plans and specifications on file at office of City Register in the City Hall.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., Aug. 29, for furnishing all the material and doing all work necessary to repair the brick pavement on Seventh St. from Pennsylvania Ave. to Broadway.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., Aug. 29, for the construction of artificial stone sidewalks as follows: On west side of Walrond Ave. from Twenty-second St. to Twenty-third St. On both sides of Brownell Ave. from Woodland Ave. to Maple Boul. On east side of Campbell St. from Forty-eighth St. to the south line of lot sixteen, block three, Lahoma. On both sides of Colorado Ave. from Fifteenth St. to the south line of Munroe Heights. On north side of Tenth St. from Myrtle Ave. to Norton Ave. On west side of Washington St. from a point 47 ft. north of north line of lot 14, Edward Price's addition to the alley next south thereof. On both sides of Garner Ave. from Myrtle Ave. to Norton Ave. On both sides of Tenth St. from White Ave. to Fremont Ave. Plans and specifications may be seen and all information furnished at the office of the City Engineer.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., Aug. 29, for furnishing all material and doing all work necessary to complete the following improvements, consisting of the repairing of asphalt pavements: On Walnut St. from Nineteenth St. to Twentieth St. On Monroe Ave. from Smart Ave. to Independence Ave. On Tenth St. from Broadway to Central St. On Wyandotte St. from Thirty-third St. to the south line of Thirty-eighth St. Plans and specifications may be seen and all information relative to the work obtained at the office of the City Engineer.

Kansas City, Mo.—Bids are asked by E. A. Harper, City Engineer, until 11 a. m., Aug. 29, for the construction of the following asphalt pavements: On Adaline St. from West Prospect Pl. to Belleview Ave. On Twenty-seventh St. from the East line of Forest Ave. to the east line of Tracy Ave. On Thirty-sixth St. from the east line of Gillham Road to a point 135 2-10 ft. west of the west line of Locust St. On Harrison St. from the south line of Thirty-ninth St. as condemned to the north line of Forty-third St. On Grand Ave. from the north line of Twentieth St. to the viaduct over the Kansas City Belt Railway. Plans and specifications may be seen and all information relative to the work obtained at the office of the City Engineer.

Bridgeton, N. J.—Bids are asked until noon, Sept. 11, by George Reeves, Chmn. Public Road Commissioner of the Board of Chosen Freeholders of Cumberland County, for improving portion of Maiaga Road, about 5.75 miles in length. Approximate amount of work as follows: 16,420 cu. yds. of earth excavation, 9,232 cu. yds. compact gravel, arch bridge at Burnt Mill Stream, ten ft. additional to present bridge at Blackwater Stream and box culvert, 2½ x30 feet at Station No. 215.

Rutherford, N. J.—Bids are asked by the Council of the Borough of Rutherford, until 8 p. m., Aug. 30, for the grading of Raymond Ave. from Union Ave. to Erie Ave.; Washington Ave. from Carmita Ave. to Jackson Ave.; Jackson Ave. from Union Ave. to Riverside Ave.; Riverside Ave. from Jackson to Rutherford Ave. Bids must be accompanied by certified check for $500. Plans and specifications may be had at the office of the Borough Clerk, City Hall, Rutherford. F. R. Stedman, Borough Clerk.

Rutherford, N. J.—Bids are asked by the Council of the Borough of Rutherford, until 8 p. m., Aug. 30, for the grading of Elm St. from Washington Ave. to Morse Ave. Plans and specifications can be examined at the office of the borough clerk, in the City Hall, Park Ave., Rutherford. Each bid must be accompanied by a certified check for the sum of $50, payable to the order of the Borough of Rutherford. F. A. Stedman, Borough Clerk.

Rutherford, N. J.—Bids are asked by the Council of the Borough of Rutherford, until 8 p. m., Aug. 30, for the grading of St. Clair Ave. from Raymond Ave. to Beech St. Plans and specifications can be examined at the office of the Borough Clerk, in City Hall, Park Ave., Rutherford. Each bid must be accompanied by a certified check for the sum of $50, payable to the order of the Borough of Rutherford. F. A. Stedman, Borough Clerk.

Rutherford, N. J.—Bids are asked by the Council of the Borough of Rutherford, until 8 p. m., Aug. 30, for the grading of Wheaton Pl. from Addison Ave. to Woodland Ave. Plans and specifications can be examined at the office of the Borough Clerk, in the City Hall, Park Ave., Rutherford. Each bid must be accompanied by a certified check for the sum of $50, payable to the order of the Borough of Rutherford. F. A. Stedman, Borough Clerk.

Elmira, N. Y.—Bids are asked by the Board of Public Works, until 11 a. m., Sept. 4, for paving Railroad Ave. with vitrified block and asphalt on a concrete foundation. There will be required about 2,200 sq. yds. of pavement and 2,000 lin. ft. of curbing. S. F. Warner, City Clerk.

Jamestown, N. Y.—Bids are asked until noon, Sept 2, for the construction of about 23,000 ft. of cement curb and gutter, 36 concrete catch basins, 10 manholes. C. G. Jones, City Engineer.

New York, N. Y.—Bids are asked until 3 p. m., Aug. 29, by the Department of Parks, Moses Herrman, Pres., for furnishing and delivering North River road gravel for drives in Central Park. Bids are also asked at the same time for paving, curbing, etc., in portions of various streets.

New York, N. Y.—Bids are asked until 11 a. m., Sept. 4, by Bird S. Coler, Pres. Borough of Brooklyn, for regulating, grading, paving, etc., portions of various streets.

Canton, O.—Bids are asked until noon Sept. 3, by the Board of Public Service, B. F. Faust, Clerk, for paving, etc., upon gravel and concrete foundations. Estimated, $82,425. W. E. Sarver is City Engineer.

Carrollton, O.—Bids are asked until 3 p. m. Sept. 5, by W. A. Taylor, Springfield Township Clerk, for grading and macadamizing five miles of road in Springfield Township. R. H. Lee, Carrollton is Engineer.

Cincinnati, O.—Bids are asked until noon Aug. 29, by the Board of Public Service, M. J. Keefe, Clerk, for grading, paving, etc., portions of Beekman St. Estimated cost, $24,354. C. N. Dannenhower is City Engineer.

Cincinnati, O.—Bids are asked until noon Sept. 12, by the Board of Public Service, for grading, paving, etc., portions of Palm Ave. Estimated cost, $6,316.

Cincinnati, O.—Bids are asked until noon Sept. 11, by the Board of Public Service, for grading, paving, etc., portions of Kirby Ave., Ninth, Clinton, Townsend and Tremont Sts. Estimated costs, $40,546, $28,129, $27,376, $5,691 and $20,073, respectively.

St. Bernard, O.—Bids are asked by Geo Schroeder, Village Clerk, until 12 o'clock noon, Sept. 3, for furnishing material and labor necessary to lay artificial stone sidewalks 6 ft. in width and crossings at street intersections, on both sides of Carthage Pike from Railroad Ave. to Spring Grove Ave. J. A. Stewart, Village Engineer, 712 Traction Bldg., Cincinnati.

Springfield, O.—Bids are asked by the trustees of Springfield Township until 3 p. m., Sept. 5, for the grading and macadamizing of 5 miles of road, as advertised elsewhere in ENGINEERING-CONTRACTING.

Woodsfield, O.—Bids are asked until noon Aug. 30, by Geo. P. Door, Village Clerk, for grading, draining and macadamizing portion of West Court St.

Providence, R. I.—Bids are asked by the State Board of Public Roads, State House, Providence, until 12 o'clock noon, Sept. 4, for the construction of a section of State highway in the towns of Glocester and Burrillville, about 5,280 ft. in length; a section of State highway in the town of East Providence, about 10,000 ft. in length; a section of State highway in the town of Lincoln, about 3,000 ft. in length; a section of State highway in the town of Foster, about 5,280 ft. in length; a section of State highway in the town of Coventry, about 31,680 ft. in length; a section of State highway in the town of Tiverton, about 2,640 ft. in length; a section of highway in the town of Little Compton, about 5,280 ft. in length; a section of State highway in the town of Jamestown, about 5,280 ft. in length; a section of State highway in the town of Portsmouth, about 3,000 ft. in length; a section of State highway in the town of Glocester, about 10,560 ft. in length; a section of State highway in the town of Richmond, about 5,280 ft. in length; a section of State highway in the town of Narragansett, about 7,920 ft. in length; a section of State highway in the town of Warwick, about 15,840 ft. in length. Bids must be made upon blanks to be furnished by the Board. No bids will be received unless accompanied by a certified check for the sum of $200, payable to the State of Rhode Island. Plans, specifications and drawings may be examined at the office of the State Board of Public Roads at the State House, Providence.

Providence, R. I.—Bids are asked until noon, Sept. 4, for constructing sections of state highways in the following towns: Glocester and Burrillville, about 5,280 ft. in length; East Providence, about 10,000 ft. in length; Lincoln, about 3,000 ft.; Foster, about 5,280 ft.; Coventry, about 31,680 ft.; Tiverton, about 2,640 ft.; Little Compton, about 5,280 ft.; Jamestown, about 5,280 ft.; Portsmouth, about 3,000 ft.; Glocester, about 10,560 ft.; Richmond, about 5,280 ft., Narragansett, about 7,920 ft.; Warwick, about 15,840 ft. Plans, specifications and drawings may be examined at the office of the State Board of Public Roads, at the State House, Providence, R. I., on and after Aug. 28. Arthur H. Blanchard is Assistant Engineer.

Ft. Moultrie (Moultrieville Postoffice), S. C.—Bids are asked by J. M. Fulton, Q. M., for constructing roads and walks.

Jacksboro, Tenn.—Bids are asked until Sept. 3, by the Board of County Road Commissioners, R. B. Bard, Chmn., for road construction.

Fond Du Lac, Wis.—Bids are asked until Sept. 2, by the Board of Public Works, L. A. Pettibone, Chmn., for paving portion of East First St. with brick and paving various streets with asphalt and constructing combined curb and gutters.

Madison, Wis.—Bids are asked until Sept. 13, by O. S. Norsman, City Clerk, for macadamizing portion of Jefferson St. J. F. Icke is City Engineer.

Sewers.

Items Arranged Alphabetically by States.

Richmond, Ind.—Bids are asked by the Board of Public Works until 10 a. m., Aug. 30, for the following described public improvements: For the construction of a sewer system and disposal plant for the benefit of property located west of the Whitewater river and south of West Main st. (Certified check $1,200.00.) Also for the construction of a 4 ft. sewer from the outlet at Sheridan St. and P., C., C. & St. L. Railroad south in Sheridan St. to the alley north of Laurel St.; thence west in said alley and the alley north of Chestnut St. to West Second St.; thence north in West Second St. to Center St.; thence with a size of 6 ft. diameter to State St.; thence with a size of 24 in. diameter west to alley west of West Second St.; thence north in said alley to alley south of Charles St.; thence west in said alley to west line of Mary J. Stevens addition; thence also east in said alley to West Second St. with a size of 12 in. diameter; thence also in the alley north of Chestnut St. from West Second St. to West Fifth St. with a size of 24 in. diameter. (Certified check $500.00.)

Des Moines, Ia.—Bids are asked by the Board of Public Works until 11 a. m., Sept. 13, for the construction of a 12 in. vitrified clay pipe sewer on Capital Ave. from Eighteenth St. to Nineteenth St., about 652 lin. ft. of sewer. Work to begin on or before Sept. 25 and to be completed before Oct. 25.

Alexandria, La.—Bids are asked until Sept. 3, by the Board of Aldermen, for the construction of about 5 miles of 8, 10, 12 and 14 inch pipe sewers, together with manholes, etc. Ira W. Sylvester is City Engineer.

Norfolk, Neb.—Bids are asked by Julius Hulff, City Clerk, until 12 o'clock noon, Aug. 30, for the construction of district sewer No. 1. Bids will also be received at same time and place for the construction of a main sewer on First St. from Norfolk Ave. to the north fork of the Elkhorn River. Also for taking up and replacing the main sewer pipes at the mouth of the main sewer where it enters into the Elkhorn River.

Riverside, N. J.—Bids are asked until 8 p. m., Sept. 2 (extension of date), for constructing sewerage system. The work consists of laying about 10 miles of 8 to 24-inch sewers, pump house, engines, pumps, pump well and disposal works. Irven Kollo is Township Clerk. Wm. H. Boardman is Engineer.

Kingston, N. Y.—Bids are asked by the Board of Water Supply at the office of the Secretary, 299 Broadway, N. Y. City, until 2 p. m., Sept. 3, for the construction of a portion of an intercepting sewer in Kingston. The work consists of about 5,500 cu. yds. earth excavation, 350 cu. yds. rock excavation, 4,813 lin. ft. of 24 in. vitrified sewer pipe, 77 lin. ft. 24 in. cast iron pipe and 19 manholes.

New York, N. Y.—Bids are asked by the President of the Borough of Brooklyn until 11 a. m., Aug. 28, for furnishing all the labor and material required for constructing sewer in Scott Ave. from Newtown Creek, north of Metropolitan Ave. to St. Nicholas Ave., etc. (Sec. 1.) The Engineer's estimate of the quantities is as follows: 2,946 lin. ft. 180-in. circular sewer; 106 lin. ft. 180-in. horseshoe sewer; 174 lin. ft. drop section; 19 lin. ft. connecting section; 745 lin. ft. 48-in. sewer; 470 lin. ft. 15-in. pipe sewer; 5,600 lin. ft. 12-in. pipe sewer; 1,000 lin. ft. 12-in. pipe sub-drain; 1,100 lin. ft. 12-in. temporary drain pipe; 1 manhole, class "A"; 6 manholes, class "B"; 4 manholes, class "C"; 3 manholes, class "D"; 6 manholes, class "E"; 1 manhole, class "F"; 74 manholes on pipe sewers; 12 sewer basins, reconnected; 680,000 ft. (B. M.) sheeting and bracing; 100,000 ft. (B. M.) foundation planking; 5 cu. yds., class "A" concrete; 1,000 cu. yds., class "B" concrete.

New York, N. Y.—Bids are asked until 11 a. m., Aug. 29, by Joseph Bermel, Pres. Borough of Queens, for constructing sewers, etc., in various streets, Borough of Queens.

Grand Rapids, N. D.—Bids are asked until Sept. 2, by the City Council, for constructing lateral sewer. W. V. O'Conor is City Auditor.

Akron, O.—Bids are asked by the Board of Public Service until 12 o'clock noon, Aug. 29, for the construction of a local sewer in a portion of Augusta Ave. with all necessary catch basins, lamp holes, manholes, ventilators and appurtenances.

Canton, O.—Bids are asked until noon Sept. 3, by the Board of Public Service, B. F. Faust, Clerk, for constructing storm water and sanitary sewer. Estimated cost, $9,945. W. E. Sarver is City Engineer.

Youngstown, O.—Bids are asked by the Board of Public Service until 12 o'clock noon, Aug. 30, for furnishing the necessary labor and materials for constructing a sewer on Falls Ave. from Glenwood Ave. to the present end of sewer. W. H. McMillin, Clerk.

Sumter, S. C.—Bids are asked by C. M. Hurst, Secretary, Sewerage Commissioners, until 3 p. m., Sept. 5, for the construction of a sanitary sewerage system. The work consists of about 14 miles of pipe, 8 inches to 22 inches, manholes, flush tanks, etc. William W. Lyon is consulting Engineer.

Bryant, S. D.—Bids are asked until Sept. 9, by F. R. Shepherd, City Auditor, for constructing drainage and sewerage system J. M. Raymond, Raymond, S. D., is Engineer.

Beloit, Wis.—Bids are asked until 10 a. m., Sept. 4, by the Board of Public Works, for constructing sanitary sewers in various streets. R. R. Caldwell is City Engineer.

Milwaukee, Wis.—Bids are asked by the Supervisors of the Town of Greenfield until 10 a. m., Aug. 30, for the laying of 333 ft. of 15-inch sewer pipe in Twenty-third Ave.; 256 ft. of 18-inch sewer pipe; 52 ft. of 15-inch sewer pipe, and 622 ft. of 12-inch sewer pipe in Forest Home Ave., together with catch basins, manholes and proper connections. Plans and specifications on file at the office of the Town Clerk.

Water Supply

Items Arranged Alphabetically by States.

Decatur, Ill.—Bids are asked by Albert Leach, City Clerk, until Aug. 28, for furnishing all the labor and materials necessary for the construction of a pumping station for the water works system.

Grosse Pointe Farms, Mich.—Bids are asked until 8 p. m., Aug. 31, by J. G. Armstrong, Village Clerk, for furnishing and laying about two and three-quarter miles of 6, 8 and 10-in. cast-iron water pipes, including 33 fire hydrants, valves, etc.

Norfolk, Neb.—Bids are asked by Julius Hulff, City Clerk, until 12 o'clock noon, Aug. 30, for the construction of a water main on Seventh St. from Park Ave. to Passwalk Ave.

Orange, N. J.—Bids are asked until Sept. 9, by the Common Council for furnishing material and constructing reinforced reservoir and gatehouse in West Orange. Fred. T. Crane is City Engineer.

New York, N. Y.—Bids are asked by John H. O'Brien, Commissioner of Water Supply, Gas and Electricity, until 2 p. m., Aug. 28, for furnishing, delivering and laying water mains and removing existing mains in Bedford, Clinton, Greenpoint, Harrison, Johnson, Manhattan, Meserole and Nassau Aves.; in Humboldt, Keap, Lorimer, Meserole, Oakland, Provost, Scholes, Waterbury and White Sts., and in Delmonico Pl., Borough of Brooklyn.

Bellevue, O.—Bids are asked by W. H. Erdrick, Clerk, Board of Water Supply, until 12 o'clock noon, Sept. 5, for constructing reinforced concrete walls around storage reservoirs of the Water Works. Certified check for $500 must accompany each bid. Plans and specifications may be had of the Clerk of the Board or of John C. Overmeyer, Engineer, Fremont, O.

Excavation—Earth and Rock

Items Arranged Alphabetically by States.

Bradley, Ark.—Levee Work—Bids are asked until Sept. 11 by W. H. Baker, Secretary Long Prairie Levee Board, for the construction and raising of levee from Buncom Springs to Louisiana and Arkansas line; about 450,000 yds.

Patton, Cal.—Storm Water Channels—Bids are asked by Lyman M. King, Secy., Board of Managers, Southern California

State Hospital, until 8 p. m., Sept. 10, for the improvement and rectification of storm water channels on the grounds of the Southern California State Hospital. The work consists of filling up all arroyos and the grading of all adjacent land to such slopes as will permit of ready cultivation, the construction of paved ditches and necessary culverts.

Rich, Ill.—Drainage Ditches—Bids are asked by the Drainage Commissioners of District No. 2 until 12 o'clock noon, Sept. 12, for the construction of a system of drains. Advertisement appears elsewhere in Engineering-Contracting.

Shawneetown, Ill.—Levee Work—Bids are asked by Isham Randolph, Chairman of the Internal Improvement Commission of the State of Illinois, until 12 o'clock noon, Sept. 3, for the reinforcing of the Shawneetown levee. Advertisement appears elsewhere in Engineering-Contracting.

Gardiner, Me.—Dredging—Bids are asked by Maj. Geo. A. Zinn, Corps Engrs., U. S. A., Portland, Me., until 12 o'clock noon, Sept. 19, for building training walls and dredging in Kennebec River, below Gardiner.

Sanders (Howard Postoffice), Mont.—Ditch work—Bids are asked by the Sanders Co.Operative Ditch Co., until 12 o'clock noon, Aug. 31, for constructing irrigation ditch. The work consists of excavating and placing in embankment approximately 175,000 cu. yds. of material. J. R. Thompson, Secretary. Henry Gerharz, Billings, Mont., Engineer.

Moultrieville, S. C.—Dredging, Filling In—Bids are asked by J. M. Fulton, Q. M., Fort Moultrie, until 11 a. m., Sept. 14, for dredging and filling in at this post.

Miscellaneous

Items Arranged Alphabetically by States.

Stockton, Cal.—Bulkhead—Bids are asked until Sept. 16 by R. C. Tumelty, City Engineer, for building concrete bulkhead on north side of Stockton channel. Cost estimated at $10,000.

Wilmington, Del.—Jetty—Bids are asked by Maj. C. A. F. Flagler, Corps Engineers, U. S. A., until Aug. 28, for jetty construction at new mouth Broadkill River.

Millen, Ga.—Electric Light and Water Plant—Bids are asked until Sept. 12 by H. Q. Bell, Mayor, for an electric light and water plant for this place. Estimated cost $30,000. J. B. McCrary & Co., Atlanta., Ga., are Engineers.

New Orleans, La.—Seawall—Bids are asked until Aug. 30, by Capt. James F. McIndoe, Corps Engineers, U. S. A., New Orleans, for constructing interlocking steel pile seawall at Fort St. Philip. The only bid received by Col. E. H. Ruffner, Corps Engineers, U. S. A., New Orleans, on July 15 for constructing seawall at Fort St. Philip was submitted by Christie & Lowe, 107 Camp St., New Orleans, at $105,100.

L'Anse, Mich.—Hydraulic Power Plant—Bids are asked by Patrick Bulger, Village Pres., until 8 p. m., Sept. 3, for constructing a hydraulic power plant. Edward P. Burch, Consulting Engineer, 1210 Guaranty Bldg., Minneapolis, Minn.

Paulsboro, N. J.—Gas Plant—Bids are asked by Charles M. Gwilliam, Borough Clerk, until 7 p. m., Aug. 29, for installation of gas plant. Wm. H. Boardman, 426 Walnut St., Philadelphia, is Engineer.

New York, N. Y.—Pier Structures—Bids are asked by J. A. Bensel, Commissioner of docks, until 12 o'clock noon, Aug. 20, for furnishing all the labor and materials required for preparing for and building structures with the necessary appurtenances on the pier at the foot of Canal St., Stapleton, Borough of Richmond.

New York, N. Y.—Fence—Bids are asked until 3 p. m., Aug. 29, by the Department of Parks, for furnishing all the labor and materials necessary to erect and complete a 3-rail post and pipe wire mesh fence in McLaughlin Park, Borough of Brooklyn.

Skaneateles, N. Y.—Protection Walls—Bids are asked by F. C. Stevens, Supt. of Public Works, Capitol, Albany, N. Y., until noon, Aug. 28, for the work of constructing a protection wall on the west side of Skaneateles Lake outlet in the village of Skaneateles, Onondaga County, N. Y. The specifications include bailing and draining; 1,050 cu. yds. excavation and backfilling; 1,000 lin. ft. bearing piles, delivered; 925 lin. ft. bearing piles, driven; 160 cu. yds. gravel lining; 3,570 sq. ft. expanded metal; 880 cu. yds. second-class concrete. The work must be completed by Dec. 15, 1907.

West Point, N. Y.—Emplacements—Bids are asked until 12 o'clock noon, Sept. 9, for the construction of two emplacements for 6-in. guns, mounted on disappearing carriages. Address Quartermaster, West Point.

Philadelphia, Pa.—Lighthouse Superstructure—Bids are asked until 11 a. m., Sept. 10, by Maj. C. A. F. Flagler, Corps Engineers, U. S. A., for erecting superstructure of the lighthouse at the Harbor of Refuge Light Station, Delaware Bay, Del.

Materials, Machines, Supplies, Tools, Etc

Items Arranged Alphabetically by States.

Portland, Me.—Engine, Generation—Bids are asked by the Board of County Commissioners, until Sept. 3, James H. McDonald, Chmn., for the engine, generator and electric wiring for the County Building. Geo. Burnham, 120 Exchange St., is Architect.

New York, N. Y.—Motor Generator Sets—Bids are asked by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a. m., Sept. 14, for 15 motor generator sets and accessories for the Navy Yard, New York.

are asked, under Circular 386, until 10:30

Panama.—Engineering Supplies — Bids a. m., Sept. 3, at the office of David W. Ross, Gen. Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for the following engineering supplies for the Isthmus: Two locomotive coaling cranes, 10-ton capacity, mounted on iron car-body with swivel trucks; lifting capacity, 10 to 14 tons at a 15-ft. free radius; two 20-ton capacity cranes on same specifications.

Two hoisting engines; cylinders, diameter, 8½ in.; stroke, 12 in.; drum, diameter, 16 in.; length, 29 in.; capacity, 40 HP.; with single rope at average speed, 5 tons; weight, 20,500 lbs.

Four hoisting engines; cylinders, diameter, 7 in.; stroke, 10 in.; capacity, 20 HP.; with single rope at average speed, 5,000 lbs.; weight, 9,500 lbs.

One vertical, 120-HP., boiler (Manning patent). One tandem steam roller, 8-ton; 2,000 ft. blow-steel wire cable; 75 steel axles; two 30-ton hydraulic jacks; frogs, switch points, switch stands, switch slide plates; 1,260 ft. culvert pipe, 24-in. and 30-in.

One tugboat, length, water line, 100 ft.; width, 25½ ft.; draft, 9 ft.; steel hull; equipped with all appliances; Scotch marine boilers, 150 HP., triple expansion, condensing engines, 500 I. HP.; equipped with electric light plant, searchlight, etc., to be new or of recent construction.

20,000 barrels Portland cement.

Lumber as follows: 200,000 ft. flooring; 200,000 ft. ceiling; 200,000 ft. ship lap siding; 300,000 ft. lumber, S. 1 S.; 1,250,000 ft. rough lumber; 1,000,000 ft. flooring, S. 2 S.; 1,000,000 ft. ship lap siding, S. 2 S.; 1,000,000 ft. ceiling, S. 2 S.; 600,000 ft. lumber, S. 2 S.; 2,400,000 ft. lumber, S. 4 S.; 700,000 ft. lumber, S. 1 S. 1 E.; 60,000 ft. rough lumber; 15,500 pieces rough lumber; all above lumber to be of various specified sizes, long-leaf yellow pine, redwood or Douglas fir; 1,600 pieces rough oak, various sizes; 4,000 ft. rough basswood; 20,000 ft. rough clear white pine; 5,000 ft. soft white pine pattern lumber; 10,000 ft. dressed cedar; 30,000 ft. long-leaf yellow pine decking; 2,000 ft. ash.

Panama.—Locomotives—Bids are asked until 10:30 a. m., Aug. 30, at the office of David W. Ross, Gen. Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing at either Colon or La Boca, 12 locomotives, four-wheeled, saddle-tank, for construction service. They are to have a gage of 36 in. and are to burn bituminous coal. Cylinders: diameter, 10 in.; stroke, 16 in. Driving wheels: diameter, 30 in. to 33 in.; weight on drivers, 34,000 to 36,000 lbs.; driving wheel base, about 5 ft.; hauling capacity on level, 1,000 tons.

New York, N. Y.—Supplies—Bids are asked until 2 p. m., Aug. 29, by the Department of Bridges, for furnishing and delivering steel and hardware supplies to the Harlem River bridges during the year 1907. John H. Little, Deputy and Acting Commissioner of Bridges.

Washington, D. C.—Supplies—Bids are asked by the Bureau of Supplies and Accounts, Navy Dept., until Sept. 3, 10 and 17, for various supplies, including building material, construction work, electrical supplies, hardware, metals, machine tools, lumber, pipe fittings, etc.

CONTRACTS LET.

Items Arranged Alphabetically by States.

Clifton, Ariz.—Building — George W. Williams has been awarded the contract for building the new concrete block schoolhouse on Hill's new addition.

Mentura, Cal.—Sewer—Duval & De Troy have been awarded the contract at 58 cents per foot for constructing a sewer on Pali and Anne Sts.

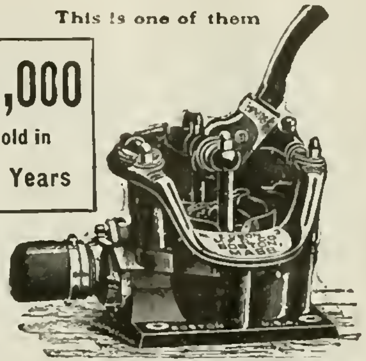
Marysville, Cal.—Bridges—C. W. Swain has been awarded the contract at $2,976 for erecting the Jasper Lane Dry Creek bridge near Wheatland, and $2,850 for erecting a bridge over Dry Creek at the Camptonville Road.

Oakland, Cal.—Bridge—Peter Mathiesen has been awarded the contract for a bridge over the creek on the Redwood Road.

Belvidere, Ill. — Macadamizing — John Fair has been awarded the contract at $17,375 for macadamizing West Lincoln Ave.

Chicago, Ill.—Paving—Parker-Washington Co. were awarded the contract at $126,000 for paving Cottage Grove ave. with creosote blocks from Thirty-ninth to Fifty-first st. Joseph Hanreddy was awarded the contract at $96,500 for paving with asphalt School and adjacent streets, Robey to Western ave. Parker-Washingon Co. were also awarded the contract at $47,000 for creosote block pavement on Milwaukee ave., Fullerton ave. to Powell st.

Joliet, Ill.—Plate Glass and Mill Work—Sime, Sawyer & Georgens Co. have been awarded the contract for the plate glass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If you have anything to sell or rent, send us copy for a "For Sale" advertisement. The price is only $1 an inch a week, thus making the cost of a trial very small indeed.

ENGINEERING-CONTRACTING, 355 DEARBORN ST., CHICAGO.

Cook has been awarded the contract for the new John Nelson School on Fourteenth st.

Muskegon, Mich.—School Building—H. J. Katz has been awarded the contract for the erection of a new school building on the Cedar Springs Road.

Evansville, Ind.—Road Work—Jesse Bedford has been awarded the contract at $3,000 for grading and repairing the Henderson Road.

Bluffton, Ind.—Bridges—The Indiana Bridge Co. of Muncie have been awarded the contract for the construction of nine new bridges.

New Albany, Ind.—The Pan American Bridge Co., Newcastle, have been awarded the contract at $1,700 for the erection of an iron bridge over Big Indian Creek.

Waterloo, Ia.—Paving—W. A. Bryant & Sons have been awarded the contract for the paving of Iowa, Webster and Franklin Sts. at the following figures: Asphalt, per yd., $1.87; excavation, 35 cents; new curb, 18 cents; new gutter and old curb, 32 cents.

·*Girard, Kans.*—Buildings—H. F. Clark, Topeka, has been awarded the contract for the new buildings at the Fort Hays State Normal School.

Salina, Kan.—Bridges—The Missouri and the mill work required for the construction of a new model school building to be erected adjoining the Roosevelt School.

Kilbourne, Ill.—Paving—E. C. Trowbridge, Chandlerville, has been awarded the contract for the construction of several blocks of concrete pavement between Chicago, Peoria & St. Louis depot and the school house.

Springfield, Ill.—Paving—The Capital City Concrete Construction Co. have been awarded the contract at $1.90 a sq. yd. for asphalting Walnut St. and 55 cents a yd. for curbing and guttering, also for asphalting State St. at $1.86 a sq. yd. and 55 cents for curbing.

Rockford, Ill.—School Building—W. H.

Valley Bridge Co. has been awarded the contract for the construction of 3 bridges, one in Gypsum Township, another in Smolan and the third in Glendale.

Port Huron, Mich.—Bridge—The Huron Bridge and Iron Co. have been awarded the contract for constructing a large iron bridge with concrete abutments in Columbus Township.

Morris, Minn.—Sewers—Tanner Bros., Minneapolis, have been awarded the contract at $7,000 for the construction of additional sewers in Morris. They completed the original contract of $30,000 on Aug. 1.

Newton, Miss.—Artesian Well—Sparry & Lukins, Artesia, N. M., have been awarded the contract for the boring of an artesian well to supply the water works system to be installed at once for the town.

Dillon, Mont.—Road Construction—Grant Kennison has been awarded the contract at $3,500 for the construction of a new road to the Elkhorn mines.

Grand Island, Neb.—Sewers—The Grand Island Plumbing Co. have been awarded the contract at $1,360 for the construction of sewers in this place.

Westfield, N. J.—Sewers—The New Jersey Contracting Co., Newark, has been awarded the contract at $30,000 for the construction of a sewer in this place.

Niagara Falls, N. Y.—Lighting System—The F. P. Little Electrical Co., Buffalo, have been awarded the contract for the installation of a lighting system in the State Park.

Oneida, N. Y.—Sewer—John De Sauza has been awarded the contract at $1,559 for the construction of 764 ft. of sewer in Lenox Ave.

Syracuse, N. Y.—Paving—The Warner-Quinlan Asphalt Paving Co. have been awarded the contract for paving Green st. from Catharine to Lodi st.

Akron, O.—Sewer—Dan O'Marr has been awarded the contract at $12,650 for constructing the main trunk sewer and filter beds west of Portage Path.

Akron, O.—Paving—E. McShaffrey has been awarded the contract at $3,762 for the paving of Good St. from Forge to Perkins St. Metropolitan paving blocks are to be used.

Lisbon, O.—Road Construction—Allison, McCullom & Co., East Liverpool, O., have been awarded the contract at $11,975 for grading and paving the East Liverpool and Wellsville Road in Liverpool Township, a distance of about 4,660 ft. Width of road to be 14 ft.

Youngstown, O.—Sewer—Anthony O'Hara has been awarded the contract at $5,551 for the construction of the Elm St. district sewer.

Zanesville, O.—Bridge—Clifton Bros have been awarded the contract at $3,555 for the construction of the Flat Run Bridge in Wayne Township.

Reading, Pa.—Bridge—L. H. Focht &

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Son have been awarded the contract at $5,180 for the erection of a new bridge over Mill Creek in Hamburg.

Philadelphia, Pa. — Factory Building—Wm. Rea's Sons have been awarded the contract at $90,000 for the construction of a cigar factory for Theobold & Oppenheimer Co.

Philadelphia, Pa.—Electric Generating Plant—William H. Dechant, Reading, has been awarded the contract at $100,000 for the construction of an electric generating plant at Manayunk, where the three levels of the Schuylkill Canal will be used for it and electric power supplied to surrounding mills.

Claude, Texas.—Buildings -Hamilton & Weaver, Claude, have been awarded the contract for a brick building for Claude Independent School District.

Nashville, Tenn.—Building—The E. T. Lewis Co. and the Foster & Creighton Co. have been awarded the contract for the construction of a new jail and criminal court house building.

Nashville, Tenn.—Sewer—John Broderick & Son have been awarded the contract at $1,483 for the construction of a sewer in Alley 370, between McMillan and Stonewall sts.

Norfolk, Va.—Sewers—Lawrence Bros. have been awarded the contract at $1.55 per ft. for the construction of the West Ogden St. sewer. Work to be completed before Dec. 1.

Spokane, Wash.—Office Building—H. J. Skinner has been awarded the contract at $150,000 for the erection of a 7-story reinforced concrete building at Sprague Ave. and Post St

' *Green Bay, Wis.*—Paving.—The Andrews Asphalt Paving Co., Hamilton, O., have been awarded the contract at $58,000, for paving 3 streets in this city.

Ladysmith, Wis.—William Lester, Chippewa Falls, has been awarded the contract for the construction of the Carnegie Library.

Racine, Wis.—Bridge. — The Illinois Bridge Co., Chicago, Ill., have been awarded the contract at $4,000. for the erection of a reinforced concrete bridge on Kinzie Ave.

Lander, Wyo.—Buildings—D. A. Robertson and L. S. Deane have been awarded the contract for the erection of the new Carnegie Library.

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STORM WATER SEWER.

Monessen, Pa., August 15, 1907.

Sealed proposals will be received at the office of the Borough Engineer until 4 o'clock p. m., Thursday, September 5th, for the construction of a storm water sewer and appurtenances as follows: 700 lin. feet of 4 foot 6 inch by 6 foot 9 inch oval shaped 3-ring brick, as per plans and specifications on file in the office of the Borough Engineer.

J. F. IRWIN,
Borough Engineer.
W. A. MILLER,
8-2t Chairman St. and Roads Com.

HIGHWAY IMPROVEMENT.

Bergholz, Ohio.

Sealed proposals will be received at the office of the Trustees of Springfield Township, Jefferson County, Ohio, until 3 p. m., Thursday, September 5, 1907, for the grading and macadamizing of five (5) miles of road in Springfield Township, between Bergholz and East Springfield. Specifications can be obtained from W. A. Taylor, Clerk, Bergholz, Ohio; R. H. Lee, Engineer, Carrollton, Ohio, or John A. Huston, Attorney, Steubenville, Ohio.

The right is reserved to reject any or all bids.

By order of the Township Trustees.

W. A. TAYLOR,
Township Clerk.

DRAINAGE WORK.

BIDS WANTED.

Drainage district No. 2, Town of Rich, Cook County, Illinois.

Notice to Contractors.

Notice is hereby given that the drainage commissioners of District No. 2 of the Town of Rich, Cook County, Illinois, will receive sealed bids at the office of Albert Reese, Town Clerk, Matteson, Illinois, until noon of the 12th day of September, 1907, for the construction of a system of drains in said district.

Each bid must be accompanied by a certified check equal to 5 per cent of the aggregate of the proposal. Checks will be returned to unsuccessful bidders upon the letting of the contract, and to the successful bidder upon the execution of the contract and furnishing a bond in the sum of $5,000, with security, to be approved by the commissioners, condition for the faithful performance of the contract.

Said commissioners will open said bids at 1 o'clock p. m. of said day at said office. Privilege is reserved to reject and any all bids.

The work to be let consists of about 6½ miles of open dredge ditch, varying from 6 to 14 feet bottom width, with side slopes of 1 to 1. Also 700 feet of 12 inch, 4,500 feet of 15 inch, and 1,600 feet of 22 inch tile, ditch having an average depth of about 5½ feet. Total excavations, about 115,000 cubic yards. Profiles, plans, and specifications for said work can be examined at the office above mentioned. Contractors are further expected to acquaint themselves with the conditions on the premises before bidding.

For information, apply to H. S. Blanchard, attorney, Chicago Heights, Illinois, or F. L. Knight & Sons, engineers, Crown Point, Indiana.

D. SIEBRANDT,
J. H. SCHUMACHER,
FRED MARQUARDT.
9-1t Commissioners.

REINFORCED CONCRETE BRIDGE.

Greenfield, Mass., Aug. 19, 1907.

Sealed proposals will be received by the Selectmen of Greenfield, until 2 p. m., Saturday, August 31, 1907, for the construction of a reinforced concrete highway bridge of 25 ft. span and 20 ft. roadway, over the Hinsdale Brook, on the Green River Road.

Specifications can be seen at the office of The Clapp & Abercrombie Company, 90 Main St., Greenfield, Mass.

The Selectment reserve the right to reject any or all bids.

E. B. BLAKE,
W. A. AMES,
C. P. ALDRICH,
9-1t Selectmen of Greenfield.

INTERNAL IMPROVEMENT COMMISSION OF THE STATE OF ILLINOIS.

NOTICE TO BIDDERS

Sealed proposals addressed to the "Internal Improvement Commission of the State of Illinois" and endorsed

"PROPOSAL FOR ALL OF THE WORK OF REINFORCING THE SHAWNEETOWN LEVEE,"

will be received by the Engineer of the Commission at the office of the Mayor of Shawneetown, Illinois, up to 12 o'clock noon (standard time) of Tuesday, the 3d day of September, 1907, and thereafter the said bids will be opened by the Chairman of the said Commission and awarded to the lowest responsible bidder; or all bids may be rejected as he may decide best.

The work to be covered by said bids is borrowing, transporting and placing Clay or other suitable material for levee building; all as set forth in the specifications under which the work will be done. The total amount of filling approximates fifty thousand cubic yards. Probably half of this amount can be most cheaply done by wagons; the other half is properly car work. Each bid must be accompanied by a check in the sum of Five Hundred ($500.00) Dollars duly certified by some bank of known responsibility and made payable to the Chairman of the Internal Improvement Commission of Illinois. Said check shall be held until the bids shall have been canvassed and the award shall have been made, and the successful bidder shall have executed the contract; then all checks shall be returned to the unsuccessful bidders, the check of the successful bidder shall be held until he shall have entered upon the work and shall be equipped for its proper prosecution; at which time his check shall be returned to him.

There is now available for this work sufficient railroad iron for any tracks needed.

Maps and specifications can be seen in the office of the Engineer in Shawneetown and in the office of the Chairman, Eighteenth Floor, of the American Trust Building, Chicago. Bidders must before bidding personally examine the ground.

No bid will be accepted until the bidder has made proof satisfactory to the Chairman of his experience in such work and his ability to carry out the contract.

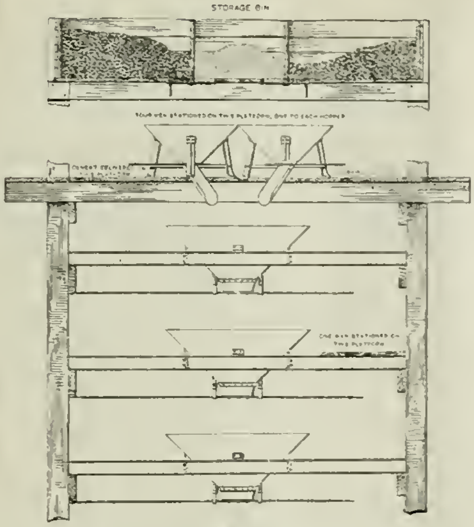
The Chairman reserves the right to reject any and all bids.

THE INTERNAL IMPROVEMENT COMMISSION OF ILLINOIS.

ISHAM RANDOLPH, Chairman.

NOTE: The time for completing this work is extended to December 15th, 1907.

9-1t



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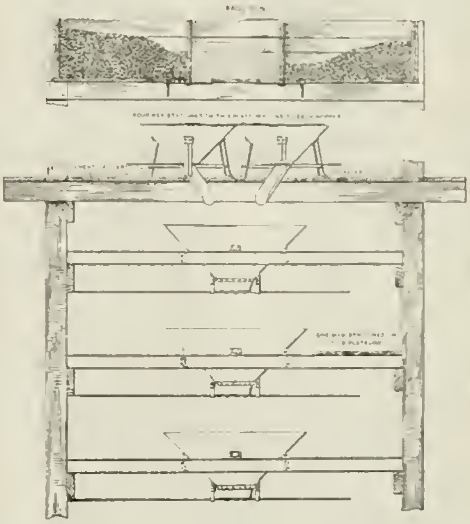

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WANTED—Second-hand blue print frame, complete, about 24x30. State make, condition and price. Address "T. L. A.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

CATALOGS—The technology department of Carnegie Library, Pittsburg, is making an extensive collection of trade catalogs. These will be carefully indexed under both firm name and subject, and will be accessible to the public. Mention this paper and address H. W. Carver, care of Technology Department.

WANTED—Required by leading German engineering works of world, wide reputation, an experienced engineer as representative with first-class connections in American railway financial circles, occupied in floating new companies and carrying out new lines; must be well up in all technical details and capable of managing also the commercial part. Send fully detailed proposals with references to F. F., 5586, care Rudolf Mosse, Berlin, S. W.

WANTED—Machinery for making garment hooks and eyes and for sewing same on cards. Dr. H. B. Cressman, 115 South 17th St., Philadelphia, Pa.

WANTED—Second-hand rails and 1½ to 2-yard dump cars. W. C. Williams, Chanute, Kan.

WANTED—A second-hand lathe to handle shafting 5 ft. long and have a 24-in. swing; also a bolt-making machine. Address S. B. Doyle, Railroad Contractor, Emerald, Neb.

WANTED--Position—Civil engineer, with 8 years' experience desires position with firm of contractors. Address "X. Y. G.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

WANTED—Dredge operator or contractor, to undertake several small contracts. Address Daniel McNabb, Drainage Engineer, Britt, Iowa.

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THE UNITED STATES CIVIL SERVICE COMMISSION announces an examination in 210 cities on September 11-12, 1907, to secure eligibles from which to make certification to fill three vacancies in the position of miscellaneous computer, Naval Observatory, Washington, D. C., and similar vacancies as they may occur in that observatory. The Department states that miscellaneous computers are paid by the hour and earn from $800 to $1,000 per annum. Promotions are made from this grade without further examination to the grade of computer, at $1.200 per annum, as vacancies occur. As an insufficient number of eligibles to meet the needs of the service were secured from previous examinations held for this position, qualified persons are urged to enter this examination.

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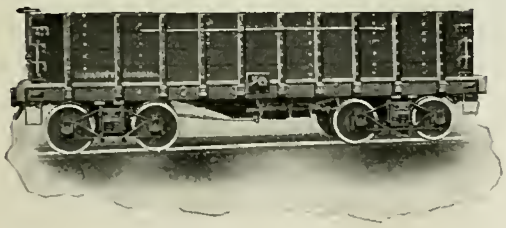

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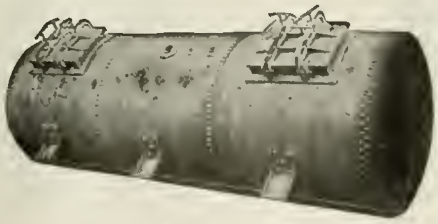

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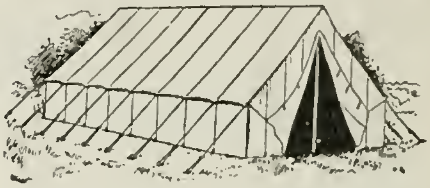

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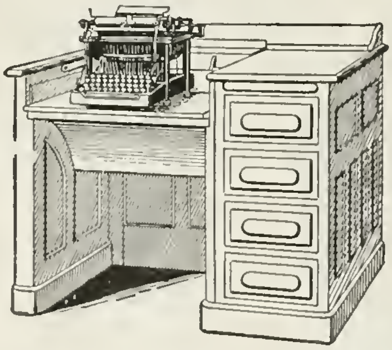

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Advantages of the Channeling Machine in Canal, Reservoir, Wheel Pit or Foundation Excavation in Rock.

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It is furnished in steam or air-driven types. The patented roller guide allows the cutting engine to run as free as a rock drill, giving "Monitor" Channelers a higher speed, a harder blow, a greater capacity and a higher economy than any other channeler. Other exclusive features are described in Catalog No. 60.

"Monitor" Channeler on the Scioto Dam Construction Columbus, Ohio.

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THE EARLY BIRD vs. THE WORM

Is an old-time childhood story with a modern-time moral.

A paper printed in Chicago on Tuesday night of each week will carry a news item or proposal advertisement to three-fourths of the contractors of the United States forty-eight hours earlier than any engineering paper in New York. This is one reason why Engineering-Contracting is a good medium for proposal advertising. Another reason lies in the fact that Engineering-Contracting has always been devoted to the interests of the contractor and engineer engaged in actual construction—it tells how others have done work and what it has cost them—and it is read eagerly each week by 10,000 of the most progressive and most reliable contractors in the world, nearly all of whom are hungry for early and definite information regarding projected work. This, in turn, when work is advertised in Engineering-Contracting, results in extensive competition and exceptionally low prices. If you are interested in any work for which bids are to be asked, be sure that the proposal advertisements are printed in

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FOR CONCRETE WORK

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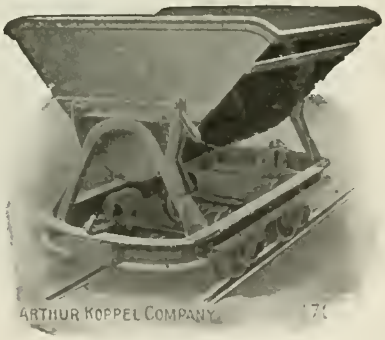

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Shows our double side dump car built in capacities of from $\frac{3}{4}$, 1, $1\frac{1}{2}$ and 2 cubic yards and gauge 18 to 36 inches.

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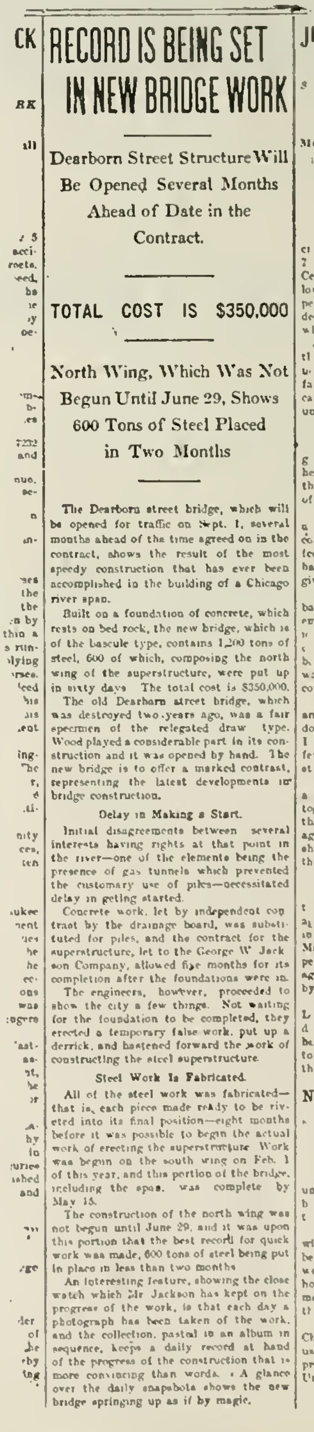
Our Steel Plant Covers an Area of 109,642 Square Feet

Dearborn Street Bridge Now Under Construction for Sanitary District City of Chicago

From The Chicago Evening Post August 16, 1907.



RECORD IS BEING SET IN NEW BRIDGE WORK

Dearborn Street Structure Will Be Opened Several Months Ahead of Date in the Contract.

TOTAL COST IS $350,000

North Wing, Which Was Not Begun Until June 29, Shows 600 Tons of Steel Placed in Two Months

The Dearborn street bridge, which will be opened for traffic on Sept. 1, several months ahead of the time agreed on in the contract, shows the result of the most speedy construction that has ever been accomplished in the building of a Chicago river span.

Built on a foundation of concrete, which rests on bed rock, the new bridge, which is of the bascule type, contains 1,200 tons of steel, 600 of which, composing the north wing of the superstructure, were put up in sixty days. The total cost is $350,000.

The old Dearborn street bridge, which was destroyed two years ago, was a fair specimen of the relegated draw type. Wood played a considerable part in its construction and it was opened by hand. The new bridge is to offer a marked contrast, representing the latest developments in bridge construction.

Delay in Making a Start.

Initial disagreements between several interests having rights at that point in the river—one of the elements being the presence of gas tunnels which prevented the customary use of piles—necessitated delay in geting started.

Concrete work, let by independent contract by the drainage board, was substituted for piles, and the contract for the superstructure, let to the George W. Jackson Company, allowed five months for its completion after the foundations were in.

The engineers, however, proceeded to show the city a few things. Not waiting for the foundation to be completed, they erected a temporary false work, put up a derrick, and hastened forward the work of constructing the steel superstructure.

Steel Work Is Fabricated.

All of the steel work was fabricated—that is, each piece made ready to be riveted into its final position—eight months before it was possible to begin the actual work of erecting the superstructure. Work was begun on the south wing on Feb. 1 of this year, and this portion of the bridge, including the span, was complete by May 15.

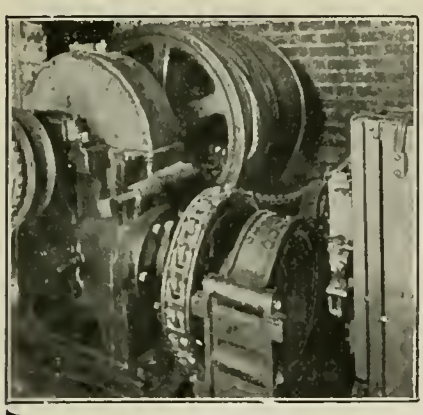
The construction of the north wing was not begun until June 29, and it was upon this portion that the best record for quick work was made, 600 tons of steel being put in place in less than two months.

An interesting feature, showing the close watch which Mr. Jackson has kept on the progress of the work, is that each day a photograph has been taken of the work, and the collection, pasted in an album in sequence, keeps a daily record at hand of the progress of the construction that is more convincing than words. A glance over the daily snapshots shows the new bridge springing up as if by magic.

WE desire to announce that we are prepared to furnish estimates and plans to architects, engineers and corporations for the fabrication of steel in all shapes, or for the manufacture of special machinery. We would also be pleased to send you catalogues, descriptive of steel ribs and lagging for moulding concrete, estimates and plans for the construction of subways, tunnels and heavy foundations.

The Company at this time is pleased to state that in the completion of some Sixty Million Dollars of constructions it has all been completed in the time specified without asking for extra compensation and without accidents.

One thousand tons of beams, channels, angles, bars and plates in stock for quick delivery, either fabricated or plain. Write for prices.



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because they overcome the weakness and complicated construction found in old styles of chain transmission.

In place of having PROJECTING Teeth on the sprocket wheels, which penetrate through the links, the CLOUSER CHAIN engages the sprocket depressions. This design removes sliding contact, reducing friction, saving power and insuring any speed desired.

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Interlocking Channel Bar Piling

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We make more kinds of buckets, tubs and skips for handling earth, stone, ore, coal, sand, gravel, etc., than any other firm in the world. These are a few pictures of buckets taken from our catalog. Notice the "shovel bucket", shoveling up broken stone. This bucket is unique in that it does not penetrate the stone, but scrapes its load off the surface, and will successfully shovel Iron Ore, Coal, Sulphur, Clay, etc. Notice also, the "iron ore bucket" handled by the locomotive crane. Notice the bottom dump bucket which can be used for placing concrete under water. Get our catalog "E 2" on buckets, and learn more about the subject.

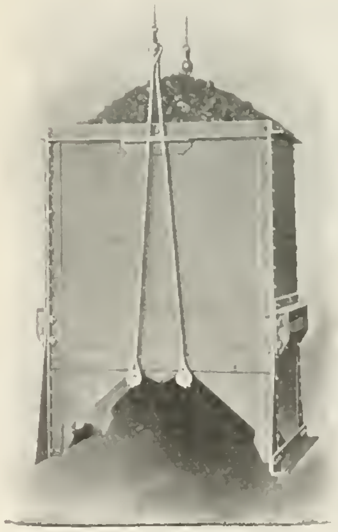
Dole Patent Grab Bucket

Shovel Bucket

Shovel Bucket Shoveling Limestone

Locomotive Crane Handling Iron Ore

Tail Latch Dumping Tub

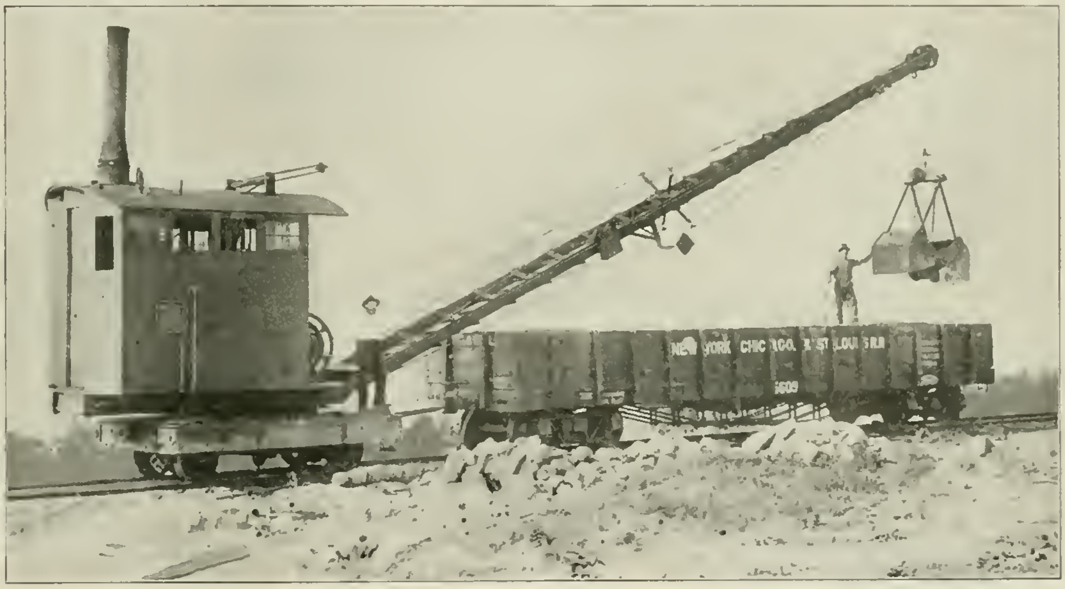

Bottom Dump Bucket for Submarine Concrete

THE BROWN HOISTING MACHINERY COMPANY

MAIN OFFICE AND WORKS, CLEVELAND, OHIO
BRANCH OFFICES, - - NEW YORK and PITTSBURG

It Digs the Sand and Hauls the Cars at 3 cts. per Yard.

We show herewith a photograph from the Browning catalog of locomotive cranes, showing how one firm is saving hundreds of dollars monthly by the use of a comparatively inexpensive plant consisting of a Browning locomotive and a Browning grab bucket. The crew consists of 2 men, namely, one crane operator and one man who takes care of switching, etc. This crane pulls two loaded gondola cars up a 4% grade. It serves, therefore, not only as a steam shovel but as a locomotive. Each car holds 45 tons of sand, and the loading and switching costs only 3 cts. per cu. yd. Our catalog of locomotive cranes shows many other uses to which Browning cranes are put by contractors. It has been truly said that no general contractor can afford to be without a Locomotive Crane. The uses to which it may be put are infinite. Some of these infinite uses are shown and described in our catalog. A study of them will surely show you how to save money in handling earth, rock, sand, gravel, broken stone, timber, etc., etc. We make all kinds of cranes and conveying machinery.



The Browning Engineering Company

CLEVELAND, OHIO

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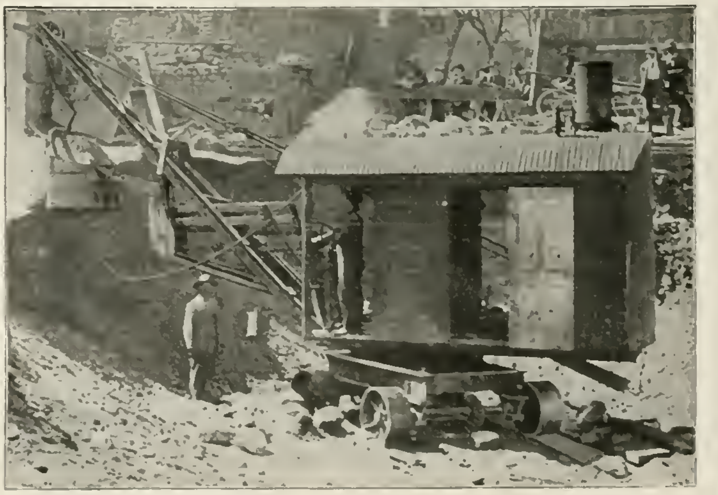

Thew Shovels for Street Excavation

One kind of excavation for which steam shovels are commonly supposed to be "out of the running" is the making of a wide shallow cut such as is often necessary in street work. While this supposition may be true of the ordinary shovel it is not true of the Thew Shovel. The Thew Shovel has recently been used in grading a city street where the depth of cut ranged from 18 inches to 2 feet, and the contractor for the work writes us that the machine has regularly loaded from 60 to 80 seven-yard cars per day, and would have loaded 90 to 100 had the facilities for getting the cars to the shovel been such as to keep the shovel up to the full capacity. The Thew Shovel swings through a complete circle excavating and delivering its load on all four sides, and can enter the work in any desired direction.

Send for our catalog No. 10 and for information regarding the use of the Thew Shovel in street work.

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We originated the Power Bank Spuds and are fully protected by U. S. Patent. All infringements will be prosecuted

Steel Gear, Return Flue Boiler, Plain Belt Frictions, Up-to-Date Practical Money Maker, Built to Run Without Repairs.

Our Dredges are known all over the country, and every owner, operator, runner and cranesman of a Fairbanks Dredge is our friend

SEND FOR CATALOG No. "D"

The Fairbanks Steam Shovel Company
MARION, OHIO, U. S. A.

J. E. MARBAUGH, General Agent, Monterey, Ind.
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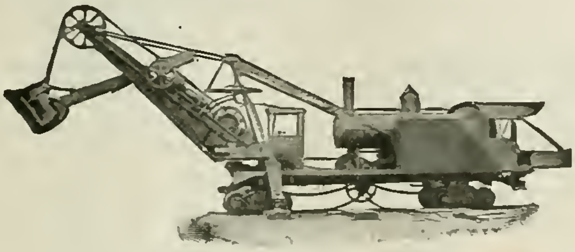
ATLANTIC STEAM SHOVEL



Commends Itself To Users For Its
Simplicity of Design
Better and More Efficient Boiler
Easy Steaming and Low Fuel Consumption
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ATLANTIC EQUIPMENT COMPANY
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The Tidewater
Bottom Dumping Bucket

Substantially Built and Practical

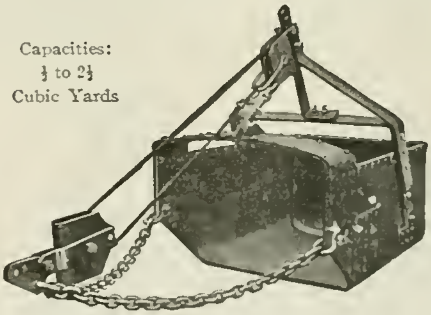
⅓ to 2½ yard Buckets in Stock

Note the Simple Dumping Device and Position of Door when Open

The Tide Water Iron Works
HOBOKEN, N. J.

The Page Patented Bucket

Capacities:
⅓ to 2⅓
Cubic Yards



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AUTOMATIC-
DUMPING-
SELF-LOADING
POWER-SCRAPER

Manufactured by

PAGE & SHNABLE, General Contractors
1002 Security Building - CHICAGO

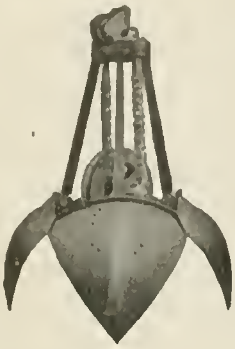
CYCLOPEAN Bottom Dumping BUCKETS

For Handling
Concrete, etc.

Can NOW supply
from STOCK

THE
CYCLOPEAN IRON WORKS CO.
402-404 Claremont Avenue
JERSEY CITY, N. J.

Write for Catalog E-C



A FULL BUCKET every time, every where,
is the record of

HAYWARD
ORANGE PEEL and CLAM SHELL
BUCKETS

Our Catalogue will "show you." SEND FOR IT

THE HAYWARD COMPANY 97-103 Cedar Street, NEW YORK

Observe the steep Angle of Bottom. It dumps clean.

BUCKETS

Note bail. Easy to hook onto and strengthens the sides.

With the labor saving, tilting device, are known as "Excelsior" Bottom Dump Buckets. For Speed and Economy no others are superior for discharging the contents rapidly and cleanly. Rock, sand and concrete are handled so expeditiously that there are no delays in completing the contractor's contracts. **One upward pull of the handle does the work.** Use the "Excelsior" and save time and labor. Write for catalog.

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SYMONS GYRATORY CRUSHER

Sold on Guarantee

LOOK AT IT!

Half the Height, size for size, of other Gyratory Crushers.

Greater Crushing Area, hence **Greater Capacity.**

Never heats. Uses less oil. Wears longer.

Think of it, and write for Catalogue.

Fifty already sold to users of other Gyratory Crushers.

Contractors' Supply and Equipment Co.

Main Office, 305 Old Colony Building, Chicago, Ill.
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of Five Place Squares and Logarithms of Feet, Inches and 32ds of Inches from Zero to 100 Feet.

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For Hip, Valley and Rafters from Zero to 18-inches; rise of 1-foot base advancing by 32ds.

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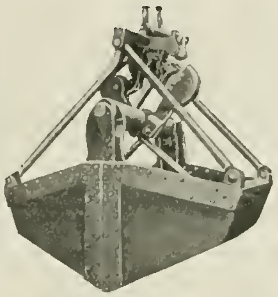

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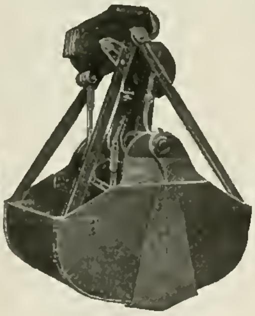

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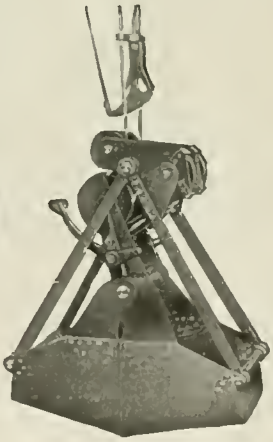

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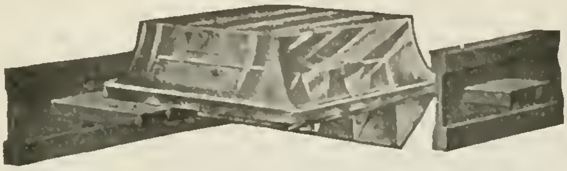

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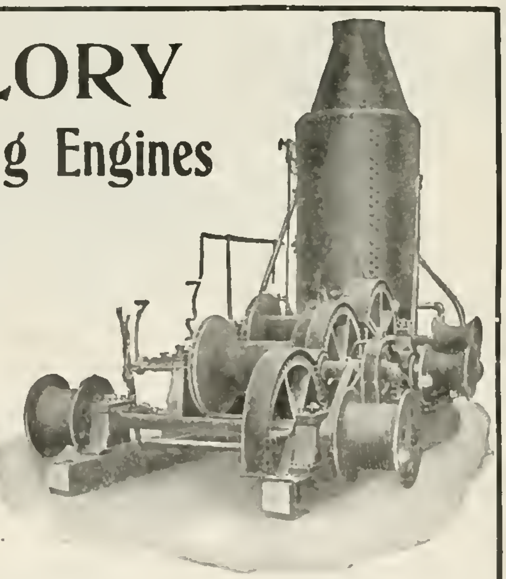

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Early last year, Halbert P. Gillette, Managing Editor of this journal, issued a call to contractors and engineers, asking them to join in forming an American Society of Engineering Contractors. Mr. Gillette agreed to act as chairman and secretary of the Society, *pro tem*, and in that capacity has received several hundred applications for charter membership. The experimental stage is past, and a large membership of influential men is now assured. We urge every contractor and every engineer to join this great national organization. One of the main objects of the society is to secure uniform and equitable general clauses in engineering specifications. Another object is to combat the inefficient "day-labor system" of doing public work, and to educate the public to the true economy of doing all work by contract. A third object is to have a voice in the solving of all social problems affecting the welfare of contractors and engineers, such as the problems raised by labor unions. A fourth object is to exchange ideas on the management of men, the operation of machinery, the keeping of cost records, and such other business as would naturally come before a national organization of this character. If you have not already applied for membership, do so on the accompanying blank; and then urge your friends to join.

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Our New Section Devoted to Concrete.

With this issue we begin the publication of a Section devoted exclusively to concrete and reinforced concrete construction. In each issue there will be articles on the methods and costs of doing concrete work, as well as articles bearing upon the design of concrete structures. Next to earth and rock excavation, there is no single subject of such wide interest to engineers and contractors as this subject of concrete. Indeed, so far as engineers are concerned, it is questionable whether any other kind of construction has more of interest in it than concrete.

While there is a number of meritorious periodicals devoted to concrete, they are nearly all monthly publications. They appeal to the general public and to builders of houses much more strongly than they do to the civil engineer and to the contractor. A contractor desires a weekly news service, and at the same time he wants articles on the methods and costs of doing work. This we shall give him, and thus we shall be the first periodical to meet all the requirements of the contractor who specializes in concrete.

We shall meet the requirements of the civil engineer not only by our methods and costs articles, but by our articles on the strengths of concrete and concrete structures and by articles on the design of such structures.

Mr. Charles S. Hill, co-author of Buel and Hill's book, "Reinforced Concrete," will edit our Concrete Section.

Our New Section Devoted to Earth and Rock.

During the last eighteen months ENGINEERING-CONTRACTING has contained a great many articles on the methods and cost of excavating earth and rock—in the aggregate enough to make a large book on the subject. There is scarcely a contractor who is not called upon, at one time or another, to "dig dirt." Hence there is probably no single line of contracting that interests so large a number of men as does excavation. With this in mind, and because there is no satisfactory treatment of this subject in any other periodical, we have decided to devote several pages each week to earth and rock excavation. Our managing editor is the author of two books on this subject, and one of our associate editors, Mr. Daniel J. Hauer, has also had extensive experience in grading and earth moving generally. That under their editorship this section on Earth and Rock will prove an attractive and valuable feature of the paper is the belief of the managers of ENGINEERING-CONTRACTING.

Why Contractors Should Unite.

Press reports state that, owing to some labor troubles that have occurred in the national capital, the contractors of the cities of Baltimore and Washington are about to form an association so as to prevent a recurrence of such difficulties. Evidently these contractors and builders realize that, because of the drifting of laboring men from one city to another, the only protection they can have against national labor unions will be through the co-operation of the contractors of the two cities. Each city standing by itself can have but little influence with labor unions, but by a strong organization they can protect their own interests.

The conditions that surround every American contractor are somewhat similar. On outdoor construction work, he is moving from one section of the country to another. Many of the men he employed are also doing the same thing, but they find in each locality a chapter or branch of the local union, hence they are always protected by their organization. How about the contractor? He has no association to assist him, so he must fight his battles alone, and they generally end by his putting his head, or his arm, or his foot, or, perhaps, only a finger, into the slip-knot the unions have prepared for him. Upon another occasion they tie him a little tighter.

The time is certainly opportune for the formation of the American Society of Engineering Contractors. Then contractors by concerted action can protect themselves, no matter where located. Several hundred contractors and engineers have already applied for membership in this society.

Your name should be on the list. Cut out the coupon printed on one of the advertising pages of Engineering-Contracting and, after filling in the blanks, mail it to Mr. H. P. Gillette, Park Row Building, New York.

Reclamation of the Florida Everglades by Drainage; an Opportunity for Drainage Contractors.

Few plans for reclaiming swamp lands in the United States have so long and so continually attracted the attention of engineers as has that of draining the Everglades of Florida. The project is claiming particular attention just now because of the law passed by the last State Legislature, amending the law of 1905 so as to give the trustees power to levy taxes for the reclamation work. It is the plan now of the trustees, who consist of the State Governor, Comptroller, Treasurer, Attorney General and Commissioner of Agriculture, to levy taxes and to push the drainage work as fast as the money is collected. While the work so far done has been done by the trustees themselves the future work will undoubtedly furnish opportunities for drainage contractors and dredge operators in considerable numbers.

The history of the Everglades reclamation project is briefly as follows: In 1850, Congress enacted the swamp-land act granting to each of eleven states all the swamp and overflowed land within its borders. The purpose of this act was to aid these states in the work of reclaiming these lands for agricultural purposes. Under the authority of this act the State of Florida organized its first Board of Trustees, composed as previously specified, in

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1855. This and succeeding sets of Trustees did little until 1905, but meanwhile two private enterprises had been inaugurated, one by Mr. Hamilton Diston in 1881, with the late Col. J. M. Kreamer engineer in charge, and the other by Col. J. E. Ingraham. In 1905 the Florida State Legislature enacted a drainage act levying a drainage tax upon private lands and the Trustees, with this source of income in view and with a sum of $352,000 accumulated from the sale of swamp and overflowed lands granted the state by the Federal act of 1850, began operations looking toward drainage work by ordering two dredges built for canal digging. Before much else could be done the courts issued an injunction against the collection of taxes under the law of 1905. The law re-enacted by the last legislature corrected the errors which were the basis for the injunction in case of the original act, and it is under this perfected act that work is now being planned.

The key to the drainage of the Florida Everglades is Lake Okeechobee. This body of water covers some 1,200 square miles and it is its overflow that covers the bordering low lands with from several inches to several feet of water during rainy seasons. To lay permanently dry a large portion of the flood lands requires simply that the level of Lake Okeechobee be lowered by drainage canals leading to the Atlantic Ocean or the Gulf of Mexico, and this is what the Trustees plan to do. The work at present in progress consists of two canals, both starting at New River and extending northwest to Lake Okeechobee, and it is being done, as before stated, by dredges owned by the Trustees. The two canals in progress, however, will when completed barely make a beginning in the complete drainage of the Everglades. They will have to be paralleled by several other canals to the Atlantic coast and supplemented by probably one canal to the Gulf of Mexico by the way of the Caloosatchee River, and finally these main parallels will have to be connected by a system of cross-canals. Altogether it will be a work of years before the drainage of the Everglades will have approached completion. It is in this future work that Southern drainage contractors and dredge operators have their opportunity to secure long and continuous employment. It is an opportunity which should not be allowed to slip by without an effort on the part of these contractors to realize on it.

A Word of Thanks to Our Readers.

On the 4th of July, a year ago, in an editorial entitled "A Declaration of Dependence," we asked our readers to assist us in building up this paper by referring to it whenever they had occasion to write to advertisers for catalogues or prices. We explained that many advertisers "key" their ads by the use of different street numbers or different catalogue numbers in different periodicals, and that they estimate the relative worth of a periodical as an advertising medium by the number of inquiries that can be traced to it. We asked our readers to remember that we could not exist without advertising patronage, and we told them that in order to hold the advertisers we then had we must show "results."

At that time we had just 37 advertisers. We now have 260 advertisers, for we have held those that we had then, and we have steadily added to the list. We have never printed "decoy ads," nor have we cut rates to secure advertisements. We were determined to win honestly or not at all, but we knew from the beginning that our success was largely in the hands of our readers. For that reason we determined to ask our readers to help us if they felt that we were worthy of it. We printed very few reading pages—only six—but we tried to make them better than any other pages of their class to be found elsewhere. We asked our readers whether they would like more pages of the same class in each issue, and we promised more as fast as our advertising patronage would enable us to print more. Our advertising patronage has increased and we have increased our editorial staff and our reading pages. We plan a much greater increase in the year 1908 if our growth in readers and in advertising continues.

We are printing the only weekly periodical in America devoted solely to civil engineering and to contracting. We believe that civil engineering in its various branches, such as bridge engineering, municipal engineering, railroad engineering, highway engineering, and the like, offers a field large enough to satisfy the most ambitious periodical. We believe that the business of contracting for engineering structures is so dependent upon civil engineers that its features are best discussed in a paper read by civil engineers as well as by contractors. Our readers must have believed in this policy of ours, for they have renewed their subscriptions, they have helped us to get other subscribers, and they have taken pains, in many instances at least, to mention Engineering-Contracting when writing to advertisers. And we thank them for it.

Great as has been our growth in advertising patronage, it has not kept pace with the increase in the number of our readers. In some ways this is unfortunate, for we are unable to carry the burden of the extra number of papers that must be printed and, at the same time, add as many reading pages as we want to add. For the reader should remember that the subscription price is only a small part of the necessary revenue that a paper derives. Hence, unless advertising patronage keeps pace with the growth in subscriptions, a paper may actually be injured financially by too great prosperity in its subscription department. We believe that our readers will be even more thoughtful in the future if they understand such conditions as these, and that they will neglect no opportunity to assist an advertiser in tracing the source of an inquiry for his catalogue; for, by so doing, they will continue to be great factors in the growth of Engineering-Contracting.

By stating matters in this plain fashion we feel that we are not begging a favor, for we are confident that we shall repay our readers many fold for their assistance. Their payment will come in the form of a larger and better paper. Our interests are, therefore, identical. We shall renew our "Declaration of Dependence" by quoting a paragraph from our editorial of July 4, 1906:

"Of course, if some other journal furnishes information in its reading pages more to your liking, have a care to mention that journal whenever you write to advertisers. It seems like a small matter—this giving a journal credit for the effectiveness of its advertising—but it is really a matter of life or death with every journal. The wonder is that the different journals are themselves so shy about mentioning the matter. Perhaps they think it a confession of weakness to say anything on the subject. Well, as for us, this is a declaration of dependence. We depend upon you for our success, and we are not ashamed to say so. Why should we be? Is not every man in business or professional life dependent upon his fellows? There is nothing to be ashamed of about dependency when it is an interdependency. We trust and believe that you will find your actions often guided by the data published in these pages—that you will put your dependence upon us. We trust and believe that you will learn cheaper and better ways of doing construction work by studying our reading columns. We trust and believe that we shall be a factor in securing fairer and clearer specifications. We trust and believe that our contract news will be the means of your getting work that you would not otherwise secure. Thus we hope to make you feel more or less dependent upon us. With your aid, as above suggested, our success is assured; and, upon our success, your success should depend in a measure, if ours is the kind of paper you really need."

A certain self-made man bragged that he owed success in life to not a soul but himself. "I have got where I am," said he in an interview, "by the help of no one. I never went to school a day in my life. I taught myself to read, and then I learned arithmetic, bookkeeping, business law, and all that's been of much use to me, from books." "Who," interrupted a reporter, "who wrote the books?"

Let there be an end of assured independence in this world. We owe to others, dead or alive, much that we have and all that we are.

Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

The Mushroom System of Reinforced Concrete Building Construction.

BY A. S. MALCOLMSON, C. E.*

In considering the relative economy of the various types of concrete building construction now in use, regard should be had not only to the economy in material actually put into the structure, but also to the ease and consequent cost with which the work can be handled by the contractor, and the economy of space obtained in the building, as well as to the cost of placing the interior walls and fittings. These considerations governed the design of the mushroom system of reinforcement which is illustrated in the accompanying cuts and which is briefly described by its inventor, Mr. C. A. P. Turner, M. Am. Soc. C. E., as follows:

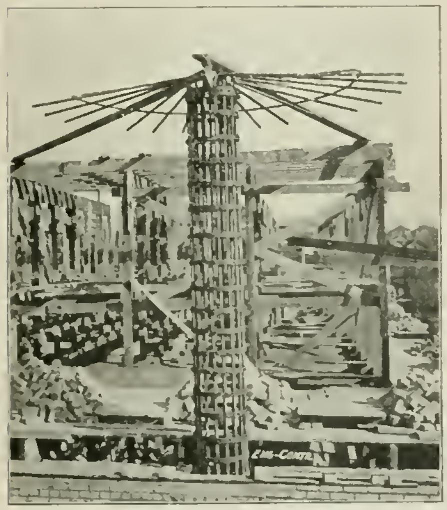

Fig. 1. Wall Column Reinforcement in Position.

"The essential feature of this new construction is the formation of a so-called mushroom at the top of each column, by extending its reinforcing rods, laterally, some four feet or more out into the slab in a radial direction and supporting on these, ring rods, which, in turn, carry the lighter reinforcement for the slab construction. The top of the column is enlarged, forming a neat capital, which assists in taking the additional stress which comes upon it in supporting the entire slab at this point. The slab reinforcement consists of parallel rods of small diameter, running between adjacent mushrooms, both at right angles and diagonally, and of a width equal to the diameter of the mushrooms. The slab rods are strung over the mushroom frames and are given the necessary sag to bring them near the bottom of the slab between the columns. They are further wired together at their intersections to form a netting and to hold them securely in place. In this manner, the steel reinforcement is well distributed through the slab, which is thereby made continuous in all directions."

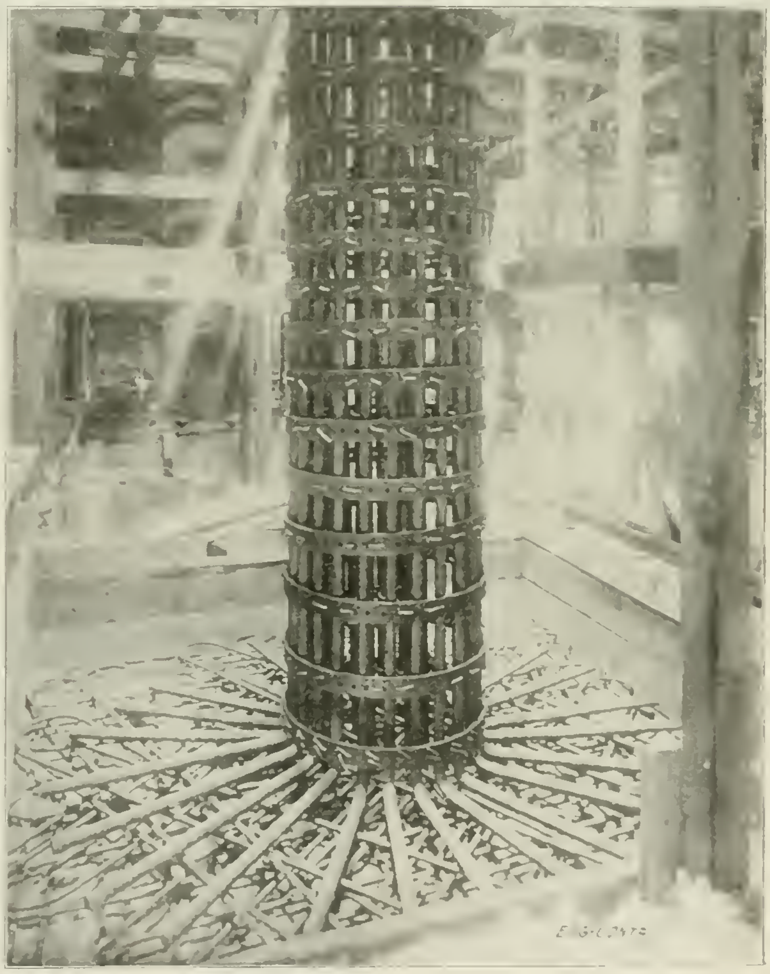

Fig. 2. Column Footing and Reinforcement.

This description in connection with the illustrations shown here give a very clear idea of the system of construction. Fig. 1 shows the reinforcement for one of the columns for a brewery stock house constructed in St. Paul, Minn. The mushroom shown in this cut is a half-circle, its column being an entire wall column Fig. 2 shows the footing of one of the columns in the same structure, with the column reinforcement in place ready for the concrete. Fig. 3 gives a good idea of the mushroom heads, and also of the slab reinforcement. The photograph was taken looking down on the first floor of the Lindeke Warner' Building in St. Paul, during its construction. This building, one of the largest reinforced concrete structures in the country, consists of seven floors and a basement, has a floor area of over 38,000 sq. ft., and is designed to carry a load of 750 lbs. per sq. ft. of floor area. The appearance of the interior of the structure is well shown in Fig. 4, which is a view of the first floor of the Lindeke Building, taken immediately after the floor forms had been struck and removed. The floor shown is the same as that of Fig. 3. This photograph gives a very good view of the flat ceiling and of the enlarged heads of the supporting columns.

The items which determine the economy of one type of reinforced concrete building construction over another may be briefly stated as follows:

(1) The Forms—The amount and cost

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*Orange, N. J.

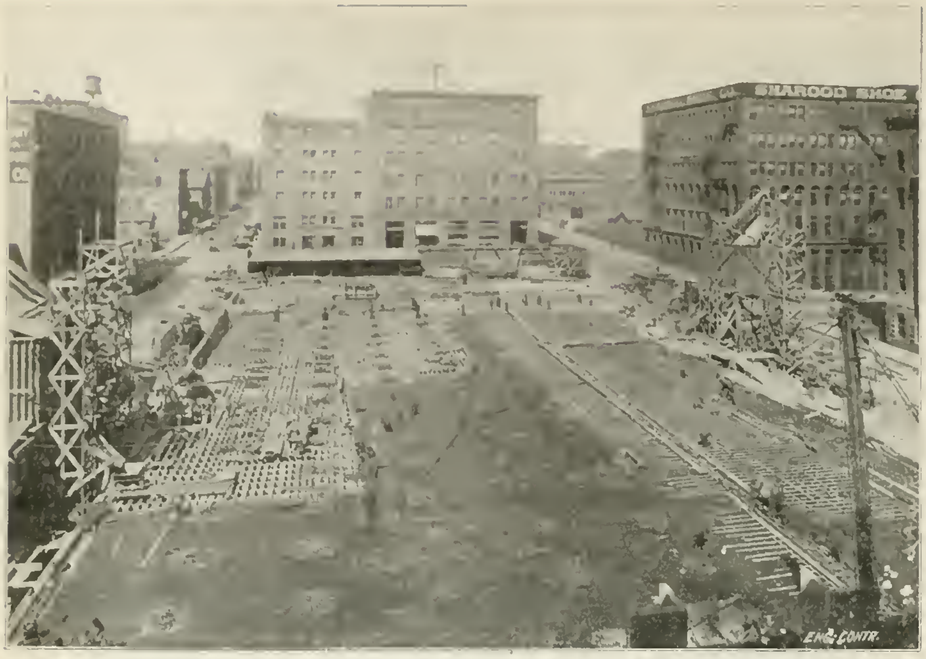

Fig. 3. First Floor of Lindeke Building Under Construction.

of material entering into them; the class of labor and the time necessary to erect them; their adaptability for repeated use; and their scrap value on completion of the work.

(2) The Reinforcement—Its cost at the mill; the space, labor, and time required to store it; and the labor and time necessary to handle and to place it.

(3) The Concrete—Its yardage; the rapidity with which it can be placed; the class and amount of labor necessary to spread it; and the time which must elapse before it is possible safely to remove the forms.

(4) The Interior Walls and Finishing Work—The labor and material, and to a certain extent the time, necessary to make the building ready for occupancy after the removal of the forms.

Other points which affect the relative economy more indirectly are: (5) The adaptability of the construction to the requirements of the tenants; such as the appearance, the arrangement of the interior walls, the illumination, and the transmission of sound and heat; (6) the fireproof qualities of the construction; and (7) the final strength of the structure.

In considering the economy of the mushroom system it is noticeable that the advantage is directly traceable in nearly every instance to the fact that the ceiling obtained is flat, and not ribbed with girders. In fact, it was that detail in particular which led to the invention of the system.

This is very noticeable in the case of the floor forms, which in the "flat slab" system consist of nothing but a flat support, making the amount of material required considerably less than in the "beam and slab" system, as all the extra lumber and supports for framing around the beams in the latter construction is eliminated.

A conservative estimate of the saving of the "flat slab" system in this particular might be set at about 10 per cent of the total material entering into the forms. Considering the present price of lumber and the large proportion of the cost of construction which is caused by the forms, this item alone makes quite a saving in the total cost of the structure. In many buildings the cost of the form material alone is 20 to 30 per cent of the cost of the finished structure, and some cases are on record in which this figure is as high as 50 per cent. It is therefore clear that any saving in amount of material or any system which requires only the simplest and the cheapest class of lumber for forms, is well worthy of careful consideration. It should be remembered, however, that as the number of floors planned is increased this saving becomes less, owing to the repeated use of the same forms, and the consequent decrease of the proportion which the cost of material for forms bears to the cost of the entire structure.

In comparing this item of cost in the "flat slab" system, with the cost in the "beam and slab" system, it is also necessary to bear in mind the fact that the size or location of the beams in the latter system is apt to vary on different floors, thereby necessitating in most cases the use of a certain amount of extra lumber for each floor. The flat ceiling reduces this to a minimum, the most that is necessary being the shortening or splicing of the posts which support the floor forms. Contractors who have used this system in construction figure that the loss of material in shifting forms is less than 5 per cent, thus allowing them to serve 20 times before they are finally discarded.

The column forms are simple, and can readily be made adaptable to several sizes of column, especially if the circular section is adopted. They are best made of sheet or cast iron in sections of about 3 ft. in length. The column heads are generally shaped in cast-iron forms of simple construction, which may also be made adaptable to several sizes of column.

The labor necessary to erect and remove the forms for the "flat slab" type of construction is small when compared with that required to frame around girders, and, because of the simplicity of the work, it can be done with less supervision and by a cheaper class of labor. The amount of

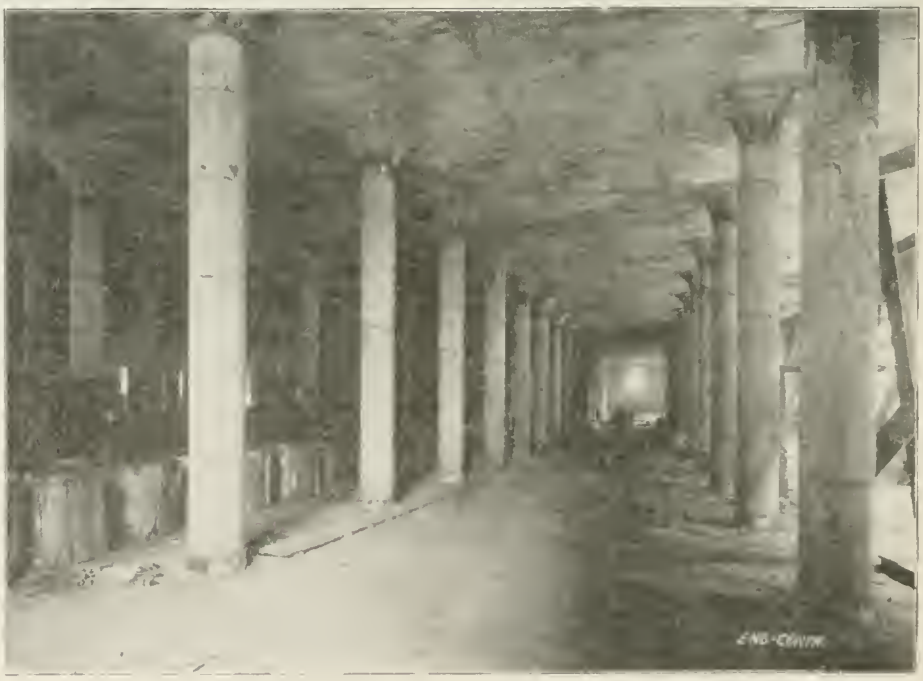

Fig. 4. First Floor of Lindeke Building After Removal of Forms.

time saved over the "beam and slab" system in this particular is very marked, and helps to get the maximum service out of the entire plant involved.

As noted above, the adaptability of the forms for repeated use without respect to location, and without reframing, and the fact that very little lumber need be cut or ordered "special," effects a saving in both the amount and the purchase price of the lumber required for the work, and also gives the scrap lumber at the end of the job a good value either for disposal as old lumber or for use on other work.

The reinforcement consists of no special forms of metal, but simply of plain round iron rods, for the slabs, and a combination of the same kind of material with plain flat iron for the columns. The vertical column rods and the ring rods for the mushroom head may be bent at the site of the work at a very low figure, and the flat bar iron for the column reinforcement may be forged or riveted into hoops either at the mill, or, if the job is a large one, this may also be done at the site of the work. This makes it possible to purchase all of the reinforcing metal at a very low figure, and to reduce the cost of handling, transportation, and storage, to a minimum. A little observation of the difficulties and cost of handling, and the space required for storing, the "stirrups" and other special pieces required for a beam construction, shows a marked economy for any system which makes use of simple rods that take up little space and are easily and quickly handled.

The extreme simplicity of the reinforcement permits of great speed in placing it, and here again it is possible to employ a cheaper class of labor and also to reduce the amount of supervision. Work has been constructed under this system in which the entire cost of handling the iron from the cars to their final position in the structure was figured at about $7 per ton.

The actual weight of metal required for the "flat slab" design, contrary to what one would suppose from a cursory examination, does not exceed that required for a "beam and slab" design of the same strength, but it is impossible to compare this item without having two given plans as a basis. It is quite evident, however, that the fact of being able to obtain the metal at a lower price per pound and to handle it at great reduction in cost, will more than offset any difference in the amount of metal required. This is also true as regards the yardage of concrete required under the two designs. It is worthy of notice in this connection, that the heavier the construction becomes, the more economical does it become as regards the material actually put into the structure.

The labor of spreading the concrete in the "flat slab" system is much less than that required to do the same work over a given area, in those designs which employ a floor beam construction. This part of the work proceeds very rapidly, and can be handled in an entirely satisfactory manner by a small amount of low priced labor.

The fact that the "flat slab" system is quick to acquire a fair working strength permits of the early removal of the forms and makes it possible to get the maximum service out of them with the minimum material. It is quite possible to remove the forms from the columns in from 12 to 15 hours after pouring, and the floor forms can, under ordinary circumstances, be struck in from 10 to 12 days after the concrete is spread, as against a period of more than 20 days in the best type of beam construction.

The importance of the finishing work and the interior walls is apt to be overlooked in comparing the relative economy of the two types of construction, but careful study will show that this item forms quite a fair percentage of the total cost of a structure. The fact that under the "flat slab" design, the partitions can be placed in any desired position without the extra work of framing around the beams, leads to quite a saving, and also helps to reduce the time which must elapse between the removal of the forms and the completion of the structure.

The fireproof qualities of the system are commendable, in that the flat ceiling prevents unequal heating, and also because the reinforcing iron is so well distributed that even should one portion of the floor be totally destroyed, the area affected would be very small. This is not the case in those types which employ beams, and place the major part of the metal in one line in the beams—just where they will be most exposed to unequal heating and destruction.

The strength of mushroom construction has been tested so thoroughly since its introduction, that it seems a waste of time to discuss it. It is, however, one of the points which up to the present has caused much trouble to those using this type of construction. The reason for this is, that owing to the newness of the system it has been difficult to obtain building permits. A case in point is that of the Bovey Building, for which the permit could only be obtained on the condition that the parties interested would take the entire risk of a test load of 700 lbs. per sq. ft. with a deflection not to exceed 5/8 in., the test being made when the cement was only ten weeks old. The floor was 7½ ins. thick with an additional finishing coat of 1½ ins. The difficulty encountered in this respect has, on the whole, been a benefit to the system, in that it has caused it to be tested under very trying conditions, under none of which has it failed to come up to requirements. These tests have been the subject of very careful study, especially with respect to the deflections under load, and it is now possible to predict the deflections under a given load within as close limits as can be done for a steel beam.

Summing up, it will be seen that its principal advantages are caused by the extreme simplicity of the whole design, which allows of the employment of a large proportion of unskilled labor with a small amount of supervision, and permits of the work being done in all its details at a remarkable rate of speed. The Lindeke Building in St. Paul, which has lately reached completion, was erected in a very short space of time, and this was one of the considerations which caused the selection of this type of construction. The whole of the concrete work was done in less than four months, which means a rate of over 2,000 sq. ft. per day, including all shifting of forms. Many good devices were made use of by the contractor in the erection of this building, and a description of them with some costs of the work will be given in a future issue.

Methods and Cost of Constructing Concrete Highway Bridges by Day Labor in Green County, Iowa.*

Five years ago the Board of Supervisors of Green County, Ia., decided to experiment with concrete bridges. The first contract was let to the Marsh Bridge Co., for the construction of a bridge over Hardin Creek, consisting of two spans, each 44 ft., and having an extreme length of 126 ft. This bridge cost $5,000, or twice as much as a first-class steel bridge would have cost. This bridge is reputed to be the best county highway bridge in the state, and the board were so well satisfied that two more contracts for small bridges or culverts were let, one a flat top, 8 ft. wide, 5 ft. high, or 40 sq. ft. waterway, costing $280, and one an arch culvert 4 ft. wide and 5 ft. high, or 20 ft. waterway, at a cost of $320. After these had been erected and tried, the county decided to continue the same form of construction, but to do the work itself. Three small bridges were built, a 6, an 8 and a 16-ft. span.

The work was very satisfactory, but a difficulty soon arose in securing men who would bend over a shovel day after day and mix the concrete properly. At the end of the second or third day the men became sour and grouchy and each day a less amount of concrete was mixed. This convinced the board that if more work of this kind was done, and good results accomplished, they must purchase a mixer. They bought a Smith mixer, run by steam engine, and mounted on trucks.

During the past season, beginning July 1, 1906, 20 reinforced concrete bridges were constructed in different parts of the county The aim was to give to each township one of these bridges to be paid for out of the bridge fund, but the work and bridges were so highly appreciated that the board decided to give two such bridges to each township. Three culverts with 4-ft. waterway, six culverts with 6-ft. waterway, six culverts with 8-ft. waterway, one culvert with 10-ft. waterway, two bridges of 14-ft. span, and two bridges of 16-ft. span were built during the season. The board has passed a resolution ordering in 14 other reinforced bridges for this year. All these bridges in Green County are wider than the ordinary bridge, each having a 20-ft. clear roadway with an extreme outside width of 22 ft. They are all of the type known as the slab or flat-top bridge. This form is simple to build, and there is no waste of lumber. The tops of these bridges are from 10 ins. to 12 ins. thick, built of concrete and reinforced with steel rails.

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*Rearranged from a paper read before the Iowa Cement Users' Convention by Mr. Henry Haag, ex-Chairman Board of Supervisors and Mr. D. E. Donovan, Foreman of Concrete Gang, Green County, Iowa.

The walls and wings are reinforced with old rods, bars or angles selected from the junk dealer's pile at 60 cts. per 100 lbs. The steel rails cost $1.15 per 100 lbs., cut to the desired lengths and delivered to any town in the county f. o. b. cars. Where a bridge stands 5 ft. high or over, reinforced concrete hand rails are put on. A large factor of safety was provided for in all of these bridges—in fact the steel in the floors alone would undoubtedly carry any ordinary load.

In the matter of gravel, Greene County has distributed here and there in pits and along the banks of the Coon River sufficient good gravel to surface all its roads and to construct its bridges. The river gravel is the best from the fact that it is absolutely clean and free from dirt. Some of the pit gravel is good, but most of it would require washing to take out the dirt and soil. It is a hard matter to state just what constitutes a good gravel for concrete, but at least it must be clean and free from earth and soil to make a good quality of concrete. Some gravel, if mixed one to six, will make a better concrete than other gravel mixed one to four, and this can only be determined by experience in the use of the same.

No person can make an accurate estimate of what such a bridge is going to cost per cu. yd. of concrete because there are so many factors for or against such cost. For instance, in the matter of excavation for bridge and foundations, in some cases the surface has looked well and yet logs lengthwise and crosswise, old willow roots and stumps and in other cases quicksand have been encountered, which required curbing to allow of excavation to sufficient depth to secure good hard footing. It is invariably necessary to go from 2 to 3 ft. under the bed of the stream to secure good footings and in several instances 4 or 5 ft. of excavation has been necessary to secure a solid base. In all foundations the footings have been about 2 ft. wide and as high as need be to get above the water and dirt. In the footings is used considerable broken rock as this cheapens the cost of concrete. The aim is to go sufficiently deep to get below any possible wash, but the streams in Greene county are sluggish and do not wash deep ditches.

Before the foundation concrete sets, steel rods, bars or angles are placed, letting them extend sufficiently high to reach into the floor from 3 to 6 ins. After this all forms for the walls, wings and floor are built before any more concrete is put in. No carpenter is employed, every man on the job having been taught to take his certain place in the work and do that particular line of work until the forms are completed. Then every man has his particular place, either in feeding the mixer, attending the boiler, wheeling gravel or broken stone. The foreman at the place of depositing concrete sees that reinforcing goes in at the right time and place. Attention must also be given to the mixing of the concrete to the right consistency; to the manner and way in which it is deposited, and to the sides to see that they are well spaded, in order that the work may be smooth and dense when stripped.

It is a short job to fill in the forms with concrete after they have been constructed. The walls are made from 10 to 12 ins. thick, while the wing walls, which run at right angles from the walls, are made one-third as wide at the base as they are high, and are battered up to 14 ins. wide on top, reinforced with heavy steel rods, for which old buggy axles are used. At the corner of walls and wing walls is bent a heavy rod at right angles and laid in, to tie walls and wing walls together and make the corner strong, this because the wing walls are ordinarily exposed to a heavy load by the fill on one side with no brace on the outside. A wheel guard is run the full length of the bridge and wing walls 12 ins. high and 14 ins. wide, on top of which is built a hand rail if required.

The concrete is used plastic or in a slush form which requires no tamping to fill all voids and air spaces. This makes a denser concrete. It was not the aim to see how cheaply these bridges could be built, but how well they could be made without profit to anyone, and with a conservative expenditure of money from the road funds. One of the most expensive bridges constructed this past summer has a 16-ft. clear waterway, 22 ft. wide with wing walls 2 ft. long. The foundations are 4 ft. deep and 2½ ft. wide. The walls on top of the foundations are 7 ft. high, 18 ins. wide at the base, and battered up to 14 ins. at the top for wings and 12 ins. at top for walls. The floor is 22 ft. by 18 ft., 1 ft. thick. The wheel guard is 12 ins. thick by 14 ins. wide and 32 ft. long. The itemized cost of this bridge, containing 73 cu. yds. of concrete, is as follows:

Materials.	Total.	Per cu. yd.
70 cu. yds. gravel at 70 cts.	$ 49.00	$0.6726
10 cu yds. broken stone at 70 cts.	7.00	0.0959
75 bbls. cement at $2.20	165.00	2.2603
7,000 lbs. steel rails at 1.15 cts.	80.50	1.1027
1,000 lbs. junk rails, at 0.6 cts.	6.00	0.0819
200 ft. B. M. lumber wasted at $29	5.80	0.0794
15 lbs. nails at 3 cts.	0.45	0.0061
Labor and Supplies:		
2 days' excavation at $14	28.00	0.3835
¾ day foundation at $14	10.00	0.1369
1½ days building forms at $14	21.00	0.2876
2 days filling forms at $14	28.00	0.3835
Hunting lumber and tools	8.00	0.1096
Hunting cement and tools	18.00	0.2465
Taking off forms	2.30	0.0315
1,000 lbs. coal at $4 per ton	2.00	0.0274
Total cost	$431.05	$5.8864

In round figures the cost per cubic yard of concrete in the finished bridge was $5.90. Summarizing we have the following cost per cubic yard of concrete in place:

Item.	Per cu. yd.
Cement	$2.26
Steel	1.22
Lumber	0.22
Gravel and stone	0.76
Labor	1.41
Coal	0.03
Total	$5.90

The average cost of concrete in place for all the work done in Greene county by day labor was $6.25 per cu. yd. In the job itemized above the bank caved in, causing an extra expense for removing the earth. The gravel used in this bridge was very good clean river gravel.

Wherever possible the back wall of earth was used for the walls, thus saving one wall of lumber. As soon as the concrete was all in, the teamster and men pulled out for the next job, the foremen remaining to trowel up the work and barricade the bridge to keep the travel off for two or three days. After three days the false work was generally removed from the hand rail, outside walls and wings, but that under the floor was permitted to remain for thirty or forty days. Travel was permitted over the bridge after three or four days.

At the beginning of the season a good set of men was employed, at $1.50 per day and board. These men were retained throughout the season and they learned to do the work in a systematic manner. Each man knew what was expected of him, and learned how to take hold of the work to make it move rapidly and to gain time.

At the head of the gang there must be a man who is proficient in the work and who understands all the details of the work and material, as the same conditions will not exist in any two jobs. In moving from place to place all over the county, one brand of cement will be found at one bridge and another brand at another bridge. The gravel is frequently of different size and quality, and requires experience to determine how it shall be mixed. Such a foreman must be a hustler if he expects to make a good showing at the end of the season.

Some Details of Costs of Reinforced Concrete Culverts and Abutments.

In the issue of Aug. 2 of the "Railway Age" Mr. Walter W. Colpitts, Assistant Chief Engineer Kansas City, Mexico & Orient Ry., has an article on the reinforced concrete structures on the Kansas City Outer Belt & Electric R. R. In it he gives the average cost of the work on the entire line, and also some examples of special structures. We quote as follows:

"All the masonry work on the line is reinforced concrete, and was done by contract under the following conditions: The work of preparing foundations, including excavation, pile driving, diversions of streams, etc., was done by the railroad company, which also bore one-half the cost of keeping foundations dry while forms were being built and concrete placed. The railroad company also furnished the reinforcing bars at the site of each opening. The concrete work was let to L. J. Smith of Kansas City (who is also the general contractor for the whole line) at $9.00 per cu. yd., which figure covered all the labor and materials necessary to complete the work, other than the exceptions mentioned.

"The concrete proportions were 1-3-5. The cement used was Iola Portland and Atlas Portland. The sand was obtained from the bed of the Kansas River in Kansas City. The rock used was crushed limestone, passing a 2-in. ring and freed from dust by screening. Corrugated reinforcing bars, having an elastic limit of from 50,000 to 60,000 lbs. per sq. in., manufactured by the Expanded Metal & Corrugated Bar Co. of St. Louis, Mo., were used exclusively. The concrete in the smaller structures was mixed by hand, in the larger by a No. 1 Smith mixer.

"In the first structures built 2-in. form lumber S1S2E was used, with 2 by 6-in. studs placed 3 ft. on centers. This was abandoned later for 1-in. lumber with 2 by 6-in. studs, 12 ins. on centers, and was found to be more satisfactory in producing a better face.

"The structures were built in the period from April, 1905, to May, 1907, and the following figures of unit cost to the contractor give an idea of the conditions under which the work was done, and the variation in prices of material and labor:

Cement.

Cost at structure, April 1905, $1.25 per barrel.

Cost at structure, April, 1907, $1.92 per barrel.

Average cost per barrel at mill	$1.42	
Freight per barrel	.21	
Hauling (average distance 1½ miles) and storage	.12	
Average cost at site of structure	$1.75	
Average cost per cu. yd. of concrete 1.1 bbl		$1.93

Sand.

Cost at structure, April, 1905, $.62½ per cu. yd.

Cost at structure, April, 1907, $0.75 per cu. yd.

Average cost per cu. yd. at river bank	$0.30	
Freight, per cu. yd.	.22	
Hauling (average distance 1½ miles)	.20	
Average cost at site of structure	$0.72	
Average cost per cu. yd. of concrete ½ cu. yd.		$0.36

Stone.

Cost at structure, April, 1905, $1.10 per cu. yd.

Cost at structure, April, 1907, $1.75 per cu. yd.

Average cost per cu. yd. at crusher	$0.65	
Hauling (average distance 4 miles)	.84	
Average cost at site of structure	$1.49	
Average cost per cu. yd. of concrete 0.9 cu. yd.		$1.34

Lumber.

Cost at structure, April, 1905, $15 per M. Ft. B. M.

Cost at structure, April, 1907, $22.50 per M. Ft. B. M.

Average cost at site of structure, per M. Ft. B. M.	$19.00	
Average cost per cu. yd. of concrete		$0.49

Labor.

Common labor, 20 cts. per hour maximum.

Common labor, 17 cts. per hour minimum.

Carpenters, 40 cts. per hour maximum.

Carpenters, 30 cts. per hour minimum.

Average cost form building and removing per cu. yd.	$1.98
Average cost putting in concrete per cu. yd.	.74
Average cost placing steel, per cu. yd.	.10
Average cost miscellaneous, wire, nails, water, etc., per cu. yd.	.20
Total cost to contractors of concrete in place, per cu. yd.	$7.14

The following unit costs to the contractor of specific structures built at different times are interesting:

Example I—Indian Creek Culvert.

14 by 15 feet, 250 feet long, completed November, 1905.

	Per cu. yd.
Cement	$1.37
Sand	.34
Stone	1.10
Labor	2.48
Lumber	.76
Miscellaneous	.18
Total	$6.23

Example II—Third Street Abutments and Retaining Wall.

Completed November, 1906.

	Per cu. yd.
Cement	$1.78
Sand	.35
Stone	1.35
Lumber	.74
Labor	2.75
Miscellaneous	.16
Total	$7.13

Example III.—Abutments, Overhead Crossing With Union Pacific and Rock Island.

Completed May, 1907.

	Per cu. yd.
Cement	$1.92
Sand	.32
Stone	1.74
Lumber	.98
Labor	2.96
Miscellaneous	.16
Total	$8.08

The walls all had pilaster behind them, which added to the labor cost of forming, but the lumber in the forms seems to have been used over a number of times. The culverts were all rectangular boxes, while the abutments were for girder bridges.

Contract has been let by the Southern Pacific Co. for the building of a rifled oil pipe line 256 miles long from oil properties in Kern County in the southern part of California to tidewater on San Francisco Bay. A new and interesting feature of the line is the character of the pipe used, its "rifled" construction being a somewhat radical departure from that of lines now in use for conveying oil. Spiral indentations accomplished in the rolling of the pipe constitute the rifling, the idea of this being that after a small per cent of water has been added to the oil, and the necessary pressure applied, that the whole will develop a whirling motion, and that the water being the heavier will seek the outside of the pipe, thereby enveloping the oil in a thin film or shell of water; this shell or film of water acting as a lubricant between the oil and the pipe, and thereby greatly reducing the friction and allowing the core of oil to glide through the pipe readily. Throughout the length of 256 miles of pipe there will be 23 pumping stations, the equipment of each station being in duplicate so that in the event of a breakage of any part of the machinery of one pump, the other may immediately be put into service. The pipe is 8 ins. in size and it is estimated that at least 23,000 bbls. of fuel oil can be delivered every 24 hours.

The Minister of Public Works of France and the Counsel General of Bridges and Highways have recently approved the expenditure of over $15,000,000 for the construction of a tunnel canal 4½ miles long, 70 ft. wide, and 43 ft. above the water level to the vaulted roof to connect the port of Marseille more directly with the Rhone River. The tunnel will be wide enough to permit the passing of two barges, will be completely lighted by electricity, and will possess a small railroad running along its side. The work is to be finished in seven or eight years and will necessitate the excavation of 2,859,333 cu. yds. of rock and earth. The course of the canal will run almost in a straight line from the River Rhone to Marseille under

The total production of all kinds of pig

the Rove Mountains.

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iron in Canada in the first half of 1907 was 270,100 gross tons, as compared with 282,010 tons in the corresponding time last year.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Specifications for Embankments.

Care should always be exercised in building an embankment, but care should also be exercised in not going to ridiculous extremes.

The following clauses are copied from a set of railroad specifications:

"Embankments shall not be built with wheelbarrows, grading machines, or by casting or by any process which does not thoroughly pack the material. Dump cars may be used only on very high hills and upon the special instruction of the engineer.

"All embankments shall be kept to the full width of cross-section at all heights while being built with the sides, at least as high as the center of the roadbed.

"In constructing any embankment except one built of hard rock material, no back dumping from carts is to be allowed, but the embankment is to be built either in six foot layers or less, or to be so sloped that the teams will constantly pass over all material as soon as it is dumped."

These are not the only clauses governing embankments. The others had been in these specifications for years, but a new engineer had been put in charge of construction for a line that the railroad company were to build, and this engineer added these three clauses to the specifications. The great part of the work done under this engineer was in very mountainous country.

A careful analysis of these clauses will show that nearly all customary methods of building railroad embankments are prohibited, except the use of scrapers. Carts can only be employed when they do not back dump, while dump cars can only be used with the engineer's permission on high fills.

How, then, are the embankments to be made from the heavy earth and rock cuts to be found in mountainous country? Teams cannot go down steep mountain sides, where the land drops forty or fifty feet in a hundred, and deposit the materials in layers.

The result will be that the specifications will be ignored, and contractors will do their work as they are accustomed to do it elsewhere. Such clauses are ridiculous, when written for railroad construction in the mountains, and they can be a great source of trouble between the engineer and the contractor.

The second clause is not an objectionable one, for it is easier and cheaper to carry out its provisions than to build a narrow bank and then widen it.

Even in country where embankments can be cheaply constructed by elevating graders, or by casting, we can see no objection to these methods of doing the work, as much money can often be saved over building railroad banks in layers with scrapers, or wagons or carts. It is obvious that the engineer was attempting to overcome certain shrinkage that would occur when earth is deposited loosely in the bank, but inasmuch as this can be overcome in several other ways, there is no valid reason why he should exclude certain machines that will save his company money. These two objectionable clauses could readily be changed to cover this point in a sensible and practical manner and accomplish better result than can be obtained in their present form.

The Cost of Excavating Earth with Wheeled Scrapers.

The following is an example of the cost of scraper work done by one of the editors of this journal on the grade of a new railroad. There were 2,000 cu. yds. in the cut, the "lead" being 700 ft. The work was done in the fall of the year, the weather conditions being very favorable. The material consisted of light red clay and sandy loam, turning into sand in the bottom of the cut. A four-horse plow team with two men was used in plowing at first, but when the sand was struck a three-horse plow team was used. The snatch team, which at first had three horses in it, was also changed to two when the sand was encountered.

The embankment was made over a tidewater marsh that in many places would not support a man. In these spots brush was put down, and the embankment was built in layers. The first layer was made by shoveling the dirt ahead of the wheelers. This extra work made it necessary to have four men on the dump, which accounts for the extra cost of dumping.

Two men were used to load the scrapers, which were No. 2½ wheelers. As in many sections only one man is employed to load the scrapers, the cost in this example is doubled.

The teams were all hired, with no pacemakers owned by the contractors doing the work. The foreman consequently had but little control over the drivers, who, for one reason and another, lost time.

One side of the cut was a bluff about 15 ft. high against which the tidewater washed. The teams could neither plow nor scrape this side of the cut down, so a gang of extra men under a foreman pulled this material down with pick and shovel, moving just enough of it so the scrapers could pick it up. It will be noticed that distributing this cost over the whole yardage moved, it amounted to 7.2 cts. per cu. yd.

The wages paid for a ten-hour day were:

Foreman	$3.00
Extra foreman	2.50
Scraper team and driver	4.75
4-horse plow team and 2 men	9.20
3-horse snatch team and 1 man	6.00
3-horse plow team and 2 men	7.50
2-horse snatch team and 1 man	4.60
Loaders	1.60
Laborers	1.50
Water boy	1.00

The foremen were paid for every working day in the week whether it was possible to work the teams or not. The rest of the forces were only paid for the actual time they made. An average of seven scrapers were worked each day.

A No. 2½ wheeler will hold ⅓ cu. yd. place measurement. This is corroborated by Gillette in his Handbook of Cost Data, page 86.

The entire cost of the work was:

Foreman, 13 9/10 da	$41.70
Scrapers, 88 3/10 da	419.42
4-horse Plowing, 8½ da	78.20
3-horse Plowing, 3 7/10 da	27.75
3-horse snatch, 8½ da	43.00
2-horse snatch, 3 7/10 da	17.02
Loaders, 24 4/10 da	39.04
Dumpers, 43 3/10 da	64.95
Water boy, 3½ da	3.50
Total	$734.58
Extra men pulling down bank:	
Foreman, 4½ da	11.25
Extra men, 88 da	132.00
Grand total cost	$877.83

This gives us a cost per cu. yd. as follows:

Foreman	$0.02
Scrapers	.21
Plowing	.053
Snatching, .03; loaders, .02	.05
Dumping	.033
Water boy	.001
Total scraper work	$0.367
Tearing down bank:	
Foreman	$0.006
Extra men	.066
Total	$0.072
Grand total per cu. yd	$0.439

An analysis of the cost gives us the following information: A scraper team traveled 6 miles per day. They should have covered a greater distance than this.

The plow team loosened 164 cu. yds. per day. This was all that was needed, but much more work could have been done by this team. The snatch team, of course, loaded the same amount. They, too, could have handled more yardage, serving the same number of scrapers.

The average yardage per scraper was 23, while the average yardage for all teams engaged was 15.5.

A comparison of this with the results given by Gillette, in "Earthwork and Its Cost" of five examples of scraper work done on the Summit Division of the Chicago Drainage Canal, may be of interest. On that work one plow loosened 200 cu. yds. per day working for five wheelers, while in this case the plow served seven with 164 cu. yds. On the canal one snatch team loaded scrapers for an average of 4.4 teams handling 175 cu. yds., against 164 cu. yds. for seven on this railroad job.

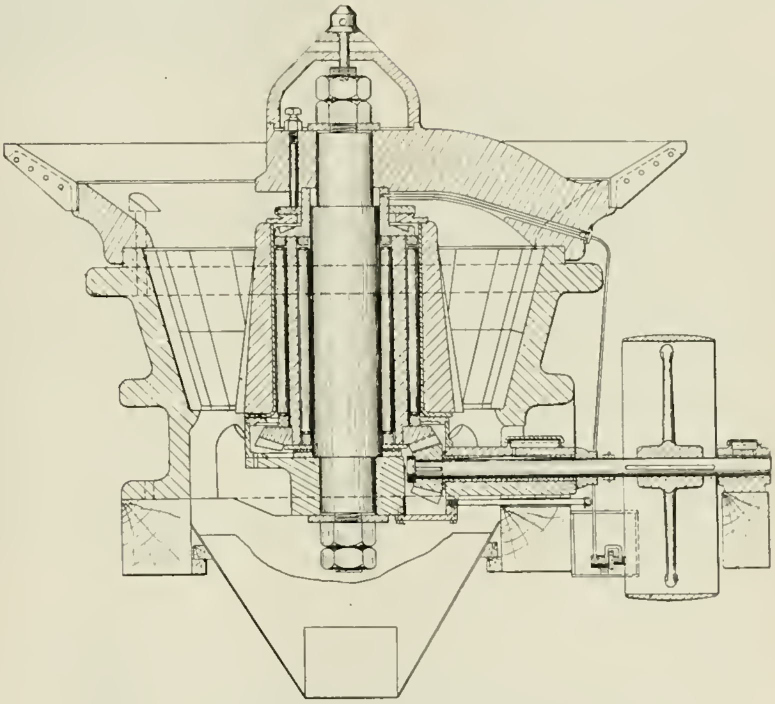
The average yardage moved per team on the canal was 28.9, while that per scraper was 41.7; compared respectively to 15.5 cu. yds. and 23 cu. yds.

A New Type of Rock Crusher.

The accompanying drawing shows the construction of a new type of rock crusher, notable for its small height and its combination in one machine of the principles of both the gyratory and the reciprocating jaw crusher. This crusher is the invention of Mr. E. B. Symons and is being placed on the market by the Contractor's Supply & Equipment Co., of Chicago, Ill., to whom we are indebted for the information from which this description has been prepared.

Referring to the drawing it will be seen that the crashing head has a movement at its top equal to that at its bottom, combining large stone holding capacity with easy feed. It has anti-friction roller bearings, reducing the power required for operation to the minimum. The main shaft is a fixed central base which adds to the strength of the machine. The receiving opening is larger, size for size, than others and it is not necessary therefore to break the stone so small for the crusher and less work is required in feeding. The crushing head is adjusted readily without disturbing the central shaft and since the discharge chute is below the shaft there is no obstruction to the free flow of the crushed product. The low, compact form of this crusher, with the above advantages, is made possible by giving the crushing head an eccentric instead of a gyratory motion.

The accompanying illustration shows the crusher in cross-section. The central shaft is made of 0.45 per cent carbon machine steel and does not revolve. It is in no sense a lever, but forms a strong central pillar brace between the upper and lower parts of the machine. Around the central stationary shaft is an eccentric sleeve rotated by gears at its lower end, which imparts to the hollow crushing-head surrounding it an oscillating or crushing movement. A set of 0.95 per cent carbon tool steel rolls, held in alignment by a suitable cage, affords an anti-friction roller bearing in the annular space between the eccentric sleeve and the fixed central shaft, and a similar set of rolls provide a like bearing between the sleeve and the crushing head. The sleeve is surrounded by the cast steel crushing head, which is made with a corrugated face. This, in turn, is encircled by the main frame, or shell, holding the concaves. The head rests upon an angle iron ring which forms a dust-proof separation between the crushing chamber and the oil cellar below. The lower end of the eccentric sleeve fits into a horizontal bevel-gear wheel, submerged in the oil cellar, and meshes with a pinion on the main driving shaft. The head is kept from rising by a top plate, or ring, held in place by vertical screws, whose upper ends enter holes near the center of the spider. All bearings are automatically lubricated by oil delivered at the top of the shaft, forced up by pressure through a pipe by a rotary pump belted to the main shaft. All moving parts are therefore immerced in a bath of oil and the oil-cellar at the bottom acts as a settling tank, from which the refuse can be drained. As the head wears in service, provision is made to maintain the width of opening by raising the head as required. This is accomplished by slackening the nuts on the holding-down screws and elevating the angle iron ring on which the head rests. This ring has a cam bearing and can be revolved bodily by means of a bar inserted at the side openings and engaging lugs provided for that purpose.



Symons Rock Crusher.

In operation, if one considers the eccentric sleeve divided lengthwise one-half becomes in effect a semi-circular wedge, constantly driven in its rotation between opposing sets of rolls, with a change of width at the top equal to that at the bottom. This arrangement of parts produces an equal eccentric movement of circumference throughout the entire length of the crushing head. Since the main shaft is stationary and does not act as a gyratory lever, it does not throw a heavy load against the spider arms as do gyratory crushers, in which the crown piece acts as a fulcrum and the crown piece thus relieved can be made in the form of a two-arm spider, providing a large opening for receiving stone. It will be seen also that this arrangement throws the crushing strain directly between the fixed central shaft and main shell, relieving the strain on all attached parts. Since the discharge chute is placed below the central shaft it is made with sole reference to the delivery of product into the elevator and it is free from any impediments to cause clogging or choking.

The Ohio Electric Ry. Co., recently incorporated with a capital of $25,000,000, has absorbed the Indiana, Columbus & Eastern, the Cincinnati Northern and the Lima and Toledo Electric Railroads. The lines absorbed include the old Appleyard line, the Columbus, London & Springfield, the Dayton, Springfield & Urbana, the Buckeye Lake and other lines throughout Ohio. The Elkins-Widener syndicate is back of the company.

Hydraulic-Fill Dams.

In the transactions of the American Society of Civil Engineers, Vol. LVIII, page 190, Mr. James D. Schuyler has a very interesting discussion of "Recent Practice in Hydraulic-Fill Dam Construction." The paper is rather voluminous, but the following data summarize its contents:

Dams built by the hydraulic process may be divided into two classes, namely, those built entirely by hydraulicking earth into the breast, which is termed "hydraulic-fill" (see Fig. 1), and those in which a breast of rock is built, against which the earth is deposited, known as "hydraulic-fill and rock-fill dams" (see Fig. 2).

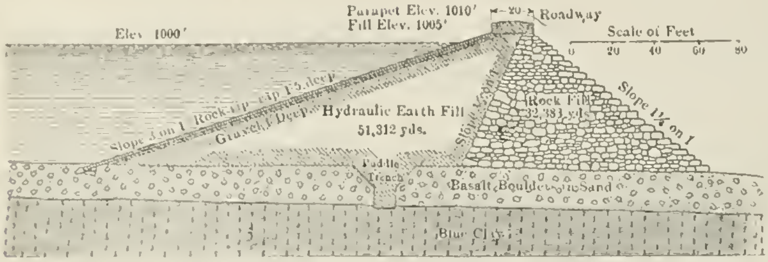


Fig. 1. Cross-section Hydraulic Fill Dam.

"The principles primarily involved in the design of any dam are the following:

"*First*—It must be founded on an impermeable foundation, and form a watertight connection with the rock or clay bed on which it rests.

"*Second*—It must be practically impervious to water, in the whole, or at least in a goodly portion, of its entire cross-section.

"*Third*—It must have slopes sufficiently flat to be stable under all conditions of saturation from the water in the reservoir, or from soaking rains.

"*Fourth*—The elevation of its crest above the highest water line must be sufficient to insure against the possibility of the dam ever being overtopped by extraordinary freshets, due to cloud-bursts, or to waves driven up its inner slope by gales of wind, or to a combination of these contingencies.

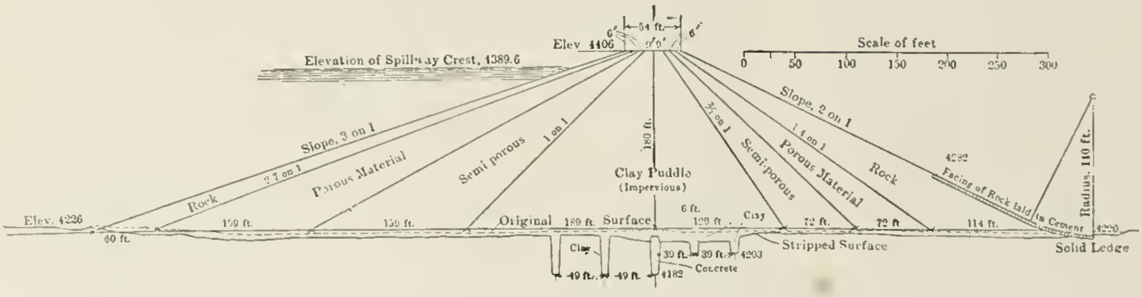


Fig. 2. Cross-section Hydraulic Fill, Rock-fill Dam.

"*Fifth*—It must not settle, crack, or show any sign of change or movement after final completion, and when put into service."

These results can be obtained with the hydraulic process as readily as with the ordinary method of placing earth by teams or cars in layers and rolling and tamping. With a breast of great height the hydraulic filled dam can be built easier and frequently cheaper if the proper methods are used.

The work is done by means of water brought in large quantities to the site of the excavation by pumps or gravity. Then it is forced through a device, which has a nozzle which is easily controlled. This contrivance is known as the "hydraulic giant" or "monitor." The pump pressure needed is generally from 100 to 200 lbs. per sq. in., while at the nozzle there should be a pressure of from 100 to 150 lbs. per sq. in., the volume of water being delivered aggregating from 10 to 15 cu. ft. per second, with a velocity of from 100 to 200 ft. per second.

These are more or less the ideal conditions, but frequently they cannot be obtained, and it is found that with good judgment and care fairly good work can be done with less pressure and velocity and less water. When water is scarce it sometimes is necessary to build a reservoir to impound it, and a second one to catch the drainings from the fill, thus using the water over and over again.

The monitor, directed against the face of a hill, will undermine the material in its pathway (see Fig. 3), cutting and loosening everything except solid rock, and this material, if seamy or disintegrated to any extent, will be swept away by the force of the giant. From the excavation pits, the dirt-laden water is carried by sluices to pipes or flumes and thus to the site of the dam.

The pit from which the earth is taken should be of a higher elevation than the crest of the dam, so as to obtain a gradient, at which the water and earth will flow to the dam. If there was only water to be carried, the grade of the pipe or flume need not be more than 1 per cent, but unless the grade is a steep one the earth particles are deposited in the flume and clog it. It is found that the grade must at least be 2 per cent, and sometimes from 6 to 8 per cent grades are necessary, when heavy materials are to be transported. The larger the amount of water the less the grade can be. The pipes or flumes are built on trestles, the deck of the trestles being above the top of the dam, the posts of the trestles being necessarily left in the fill. V-shaped flumes are found to be unsatisfactory, the square boxes without top being preferred.

"The theory upon which hydraulic-fill dams are generally planned and attempted to be carried out is about as follows: That the inner third of the dam should be composed of impervious material, or material which, by drainage and natural settlement, should consolidate into a mass which will become impervious to water, and remain in a moist, semi-plastic condition; that the outer half of each of the other thirds should be coarse, porous, open material, through which water, draining from the interior, would pass freely; while the inner halves of the outer zones should be a mixture of the coarse and fine, or a semi-porous material, in condition to act as a filter so as to prevent the escape of any of the fine particles from the inner third, but at the same time allow of the slow percolation of water through it."

Such a variation in sizes of materials is not always obtainable. Then the engineer must modify his design to meet the conditions.

Predicaments of this sort have led to the invention of the hydraulic-fill, rock-fill dam. In this kind of dam the down-stream side of the breast is built of rock, and the rest of it is hydraulic-fill. The core wall is generally the dividing line, but not necessarily so. Sheets piles are driven along the up-stream end of the rock-fill, to prevent the fine particles of earth from escaping from the center of the dam and flowing away through the rock-fill.

In depositing the sluiced material in the dam care is taken that the earth is deposited on the slopes of the breast, thus keeping them higher than the center, which allows the water to collect in a pond at that point, Fig. 4. This serves several purposes. The weight of water compacts the material as well as permitting the suspended particles to settle to the bottom, thus preventing the wasting of any of the earth excavated. Then, too, the coarse material is deposited on the slopes, while the finer granules are carried into the center, thus making up the plastic core that is so essential. In rock-filled dams it is evident that it is necessary to place a flume or pipe on the up-stream slope only, as the lower slope is taken care of by the rock.

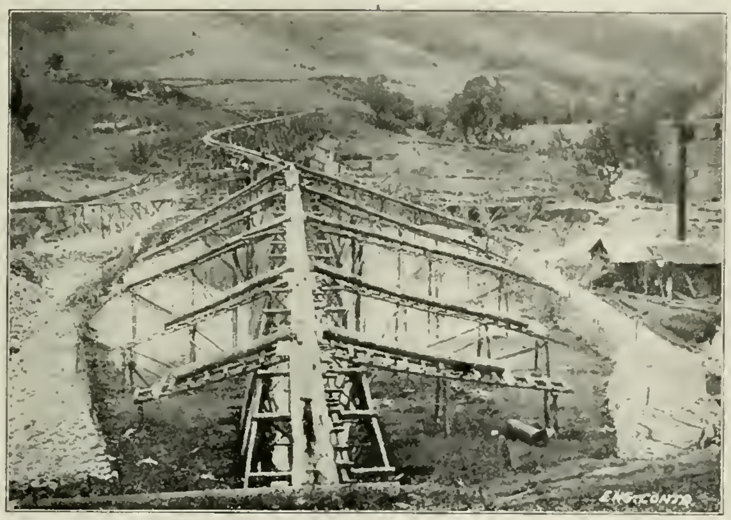


Fig. 3. Method of Distributing Sluiced Material Tenango River Dam.

The excess of water is carried from the pond in the center by flumes, or by syphons, or by connecting the waste culvert in the bottom of the breast by a small shaft, which is built up in successive layers, through the dam, keeping it at such a height as to retain four or five feet of water in the pond. As this water is run off, it can be stored, if necessary for use a second time. In designing these outlets for the water, when they run through the dam, it must be remembered that the wet material has considerable crushing pressure, and ample strength must be given to the culverts. In a number of cases of dam construction these outlets have failed.

In preparing the site of the dam, all vegetable matter, such as roots, etc., must be cleared away. This is best done by stripping. At times special preparation must be made, as, for instance, when the dam is built across a stream the bed of which contains quicksand. On the proposed dam on the Wichita River, Texas, this is the case with the channel of the river; and Mr. Schuyler, who has submitted plans for this dam, proposes "to drive steel sheet piling across the stream at the center line of the dam to serve as a cut-off for this quicksand layer, and avoid the excavation of the base to the shale bed rock. The steel piling can be driven into the clay, and will form an impervious barrier to the underflow in the overlying sand. The piles will be allowed to project upward a few feet into the hydraulic fill, and be enveloped in it."

The slopes given the dams are usually on the up-stream side 4 to 1 and on the lower side 3 to 1. In rock-filled dams the rock is placed nearly vertical against the hydraulic fill, while on the lower face it is given a good slope, as a rule steeper than the earth. Close attention must be given the slopes at all times to prevent sloughing. If this starts, brush and such materials can be used to check it. By using teams to put in the slopes, the materials can be selected and so placed that the chance of sloughing can be reduced to a minimum, but the cost commonly exceeds that of hydraulicking.

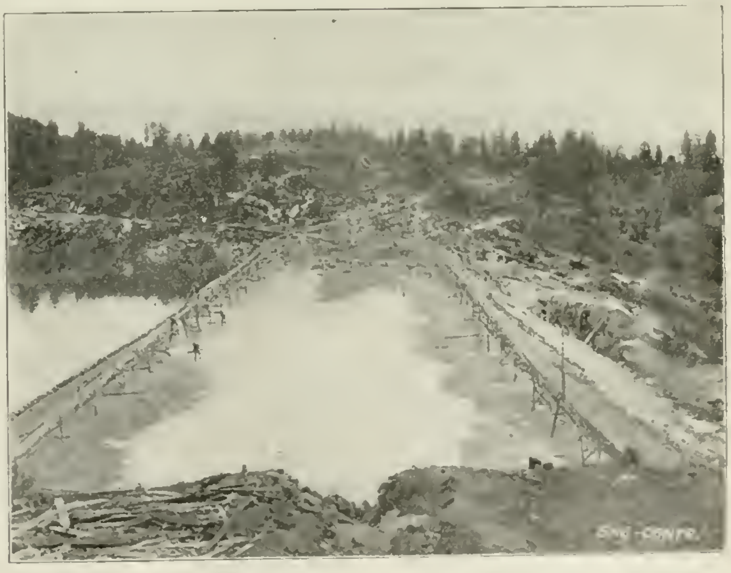


Fig. 4.—Showing Flumes on Each Side of Embankment, Also Pond in Center.

It is possible in some cases to bring water by diverting it in a ditch, by gravity, to the borrow pit and then by means of steam plows and "crowders" cut up the earth and push it into the sluice, thus carrying it to the flumes and to the dam. This work is done at times by men with picks and shovels.

The flumes and pipes that carry the material are made either to discharge directly in the breast or through laterals which can be closed off at any time (see Fig. 3), thus controlling the distribution of the material. When any one material, such as sand, begins to form a layer over the whole surface, thus making a rift through which water could percolate, a raft can be floated in the pond from which men can work boards down into the soft embankment, thus kneading the materials and mixing them up, preventing this forming of layers.

The per cent of solids carried by the water varies according to circumstance, as hardness of material, character of material, amount of water and other conditions. It runs from about 5% or 6% up to 50%. The average being 25% or less.

Most hydraulic dams that have been built have had the material loosened by the monitor and then transported by gravity to the dam. It is possible, however, to loosen the material by the monitor and then by means of pumps place it in the embankments. Naturally this is more expensive than by gravity.

In Mr. Schuyler's paper 18 dams are spoken of and some features of each described. The first mentioned is the Lake Frances dam, which involved rebuilding and enlarging an old dam made with teams, part of the breast of the dam having been washed away. Some 4,100 cu. yds. of the old break were replaced by hydraulicking at a cost of 18.27 cts. per cu. yd. Throughout the job "the minimum cost for labor on any one week's work averaged 3.8 cts. per cu. yd., sluiced and deposited in the dam. The average labor cost was about 15 cts. per cu. yd., and the total cost was probably less than 20 cts. per cu. yd., including all power, materials and plant." In all 18,300 cu. yds. were deposited in the dam. The record of power used in pumping showed that it cost 1 ct. per cu. yd. for power. Electricity was used. From the channel below the spillway 9,150 cu. yds. were excavated with the monitor at a cost of 3⅛ cts. per cu. yd.

Three dams of the hydraulic-fill and rock-fill type, on the Snake River in Idaho, are described. The earth fill amounted to 58,000 cu. yds. in one, 62,850 cu. yds. in the second and 48,000 cu. yds. in the third; 114,250 cu. yds. of rock were used in the three dams. A wooden core wall was built of 2-in. plank from the bottom to within 6 ft. of the top, "the plank being laid horizontally, breaking joints, and being spiked to 3x6-in. uprights placed 2 ft. apart from center to center. The base of this wooden partition was embedded in concrete, which filled the trench to above the line of the bed rock, and formed a tight bond with the rock."

"The principal part of the hydraulic-filling for the north dam was delivered from the north side of the river through the flume, in the upper end of which a receiving box was placed where the earth was dumped from wagons into a trap. Water pumped from the river washed it down to the dam. The earth was loaded in the wagons by a modern excavator with belt-conveyors delivering a continuous stream of earth, loosened by plows, to wagons traveling alongside until they received their load. This is an economical device, where the borrow-pit is large and need not be confined to narrow limits. The water used was about 1 cu. ft. per second, delivered by a No. 4 centrifugal pump. The lower end of the flume discharged along the upper side of the wooden core wall, first filling the voids in the rock-fill and then extending up stream in the water, assuming a very flat slope of 6 or 7 on 1 under the water line. Great difficulty was experienced for some time in stopping a few leaks through the wooden partition, and considerable earth filling was carried through the dam and lost. This may have been due to settlement of the cribs under the weight of rock, or to imperfect joining with the bed rock. The necessity for doing much of the work in freezing weather was one of the causes of the serious difficulty encountered in making the hydraulic-fill. Layers of frozen earth were formed in the embankment, and these subsequently thawed out when the water was allowed to rise against the dam, creating alarming settlement in the earth next to the rock-fill. This alarm was due to the extent of the disappearance of the earth-fill below the water line along almost the entire length of the dam, and the volume of leakage through the dam, when the water reached its normal height. This leakage was not definitely measured, but it was estimated at one time at more than 6 cu. ft. per second. In an ordinary earth dam such leakage would necessarily be fatal. In this case it was never a source of actual danger, and only resulted in the loss of 2,000 or 3,000 cu. yds. of earth filling (possibly less), before the leaks were finally closed with fine gravel brought in a barge from a few miles above."

The contract prices for these dams were: Dry earth in embankment, 27.5 cts. per cu. yd.; and sluicing earth, 37.5 cts. per cu. yd. These prices were high for several reasons, namely, the high cost of fuel, the scarcity of earth in the neighborhood of the dams and the high price of labor.

A dam built on the Island of Vahn, Hawaii, was also of the hydraulic and rock-fill type, being 98 ft. high and 580 ft. wide on the base and 25 ft. at the crest. Ground sluicing was the method used, the ground being plowed and pushed into the water, which carried it to the dam. The work of loosening and delivering the soil to the sluice was done by contract for 8 cts. per cu. yd. The cost of distributing averaged 3 cts. per cu. yd., a total of 11 cts. In all 141,000 cu. yds. were excavated; 100,000 yds. were handled by steam plows and a "crowder," a V-shaped scraper pulled by a traction engine, while 41,000 cu. yds. were handled by men with picks and shovels.

The Terrace Dam, on the Alamosa River, Colorado, 180 ft. high, under construction in 1906, is the highest hydraulic dam yet projected in this country. It is a hydraulic-fill dam, the contract price per cubic yard being 18 cts.

Four dams for the Mexican Light and Power Co. of the City of Mexico are described. They are all high dams, No. 2 being 190 ft. high above the steam bed, 1,993,700 cu. yds. being the volume in the dam.

The failure of the hydraulic dam in Merced county, California, is discussed to show some incorrect methods. This dam failed twice, and was finally abandoned.

"The simplest and most elementary precautions for any dam building appear to have been neglected, and no attempt was made to connect with bed rock or remove the hydraulic mining tailings with which the ravine was filled before construction.

"The plan adopted was to build up the lower toe with scraper teams, keeping it 2 ft. above the remainder of the dam. Material was then washed down with a hydraulic jet at the big cut and from the adjoining side hills of the basin, and sluiced to the dam site in the natural watercourses. An inclined shaft of wood, 2x4 ft. in the clear, was built inside the outer slope for carrying off waste water, and a vertical shaft of similar character was carried up at the upper toe, both connecting with a waste box of 2-in. Oregon pine, 4 ft. square, passing through the dam at the base. As no flume or pipe was used to carry the material to the outer slopes, where the gravel and boulders would be deposited, the result was that the heavier portion of the sluiced material was dropped on the way, and only the fine silt reached the dam. Without any provision for drainage, this was always in an unstable condition, constantly shaky and vibrating when jarred. It finally slid out when it had reached a height of 30 ft.

"The second attempt was made with sufficiently greater care to permit of its completion to the top, but the waste box or culvert crushed in when the structure was only 40 ft. high, and could not be used thereafter. The dam was then finished to the top with carts. With water standing only a few feet deep in the basin the leakage through the dam amounted to 1 cu. ft. per second. There was more leakage through the material deposited by carts than through the stratified material that was sluiced into position.

"The intake canal passes near the east end of the dam, and a wooden box, 4 ft. square, for a new wasteway, was put in the west end of the dam 10 ft. below the top. The intake canal is located on a steep hillside. It soon leaked and sloughed off a piece of the hillside immediately next to the dam, which they began to leak around that end. The waste box, which was also leaking, was then opened in the west cut, and washed out a large hole from the side hill and dam on its lower side. The dam was leaking at its base also. Attacked and weakened on both flank and center, the entire structure gave way and was pushed *en masse* down the ravine at a velocity of from 6 to 10 ft. per second. It thus traveled about 1,000 ft., and was dumped into the Tuolumne River, damming the stream temporarily to a depth of 20 ft. The Superintendent and two dogs were on the dam when it gave way, and they were carried entirely across the river unhurt, although, on the trip, the man's shirt and pockets were filled with sand and mud."

This waste of money was entirely due to the fact that no engineer experienced in this work was employed, but the job was turned over to a contractor to design and build.

There seems to be no limit to the height to which a hydraulic-fill dam can be built, except the limit of cost, provided it is properly designed and built.

Dredging work on the new 16-ft. channel through Newark Bay and the Pasaic river from the Kill Von Kull to Newark, 11 miles, has been commenced by the contractors, The Midland Land & Improvement Co. The new channel will be 300 ft. wide for part of the distance and 200 ft. for the remainder of the distance and the material removed will be used in filling in a tract of the Huckinsack Meadows, comprising some 3,000 acres.

Methods and Costs; Some Old; Some New.

Riprapping a Sand Slope Under Water.—To get 21 ft. of water outside a concrete sea-wall built on piles in 5 ft. of water, the sand bottom was dredged out and the slope descending from the toe of the wall was riprapped first with broken stone and then with large stones. The scow on which the riprapping was delivered was moored broadside to the piles and held the proper distance from them by timber frames. A vertical chute 40 ft. long and 5 ft. square was used to deposit the stone; this chute being dropped to the bottom and riprap dumped into it until soundings through the chute showed that the fill had reached the proper elevation. The scow and chute were then moved in toward the piles 4 ft. and riprap again placed. This operation was repeated, moving up the slope, until it was entirely riprapped. Both the crushed stone and the large rock were placed in this manner.

Righting a Tilted Caisson.—In sinking a steel caisson 26½ ft. in diameter and 31 ft. high for the pivot pier of a swing bridge over a canal the caisson tilted owing to blowouts so that one edge was some 5 ft. lower than the other. An examination showed that the depressed edge rested on a hard stratum, while the elevated edge was still in soft material. Steel cables 1⅝ ins. in diameter were attached to the caisson and carried 300 ft. to capstans anchored on the shore so that by means of the capstans a righting pull could be exerted on the tilted structure. The material under the high edge was then removed with an ejector and at the same time a considerable pull was maintained on the cables. The combined action of the capstans and the ejector gradually rotated the caisson into a level position.

Handling Concrete, Building Construction.—In a three-story and basement garage, 50x100 ft. with ell 32½x36 ft., in New York city the concrete for the first floor slab and basement columns was mixed by hand. When concreting of first floor was about finished a Smith mixer was erected in basement adjacent to elevator shaft and enough lower than the first floor to permit charging from that level. A Pelham hod elevator was installed in the elevator shaft; ⅓ cu. yd. Ransome carts received the charge from the mixer, were hoisted to the proper floor and thence run to the work.

Hanger, Pugh Factory Building, Cincinnati, O.—The device adopted for fastening bolts for transmissions to the underside of girders at the Pugh factory building at Cincinnati, O., is shown by Fig. 1. A short piece of gas pipe with the lips of one end drawn together and welded and the other end threaded on the inside is embedded in the concrete welded end up. A pin passing through a transverse hole in the upper end of the pipe provides a mechanical bond in addition to the adhesion of the concrete. To locate the pieces of pipe and keep them in position during construction pieces of cork of about the inner diameter of the pipe are nailed to the bottom board of the girder mold. The threaded ends of the pipes are screwed over these corks and so secured during the converting. In removing the forms the brittle cork is torn out of the threaded pipe without wrenching it.

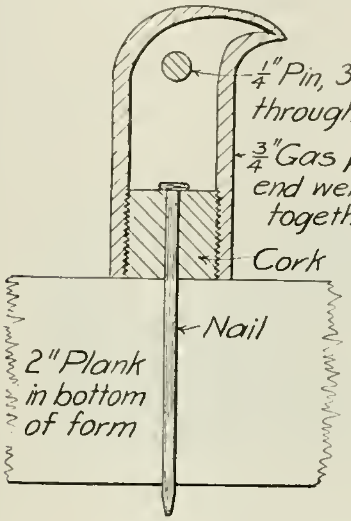

¼" Pin, 3" long through pipe
¾" Gas pipe, end welded together
Cork
Nail
2" Plank in bottom of form

Fig. 1. Device for Fastening Bolts to Concrete Beam.

Centers for Slab and I-Beam Floor.—Mr. W. A. Etherton designed and used the center shown in the accompanying drawing in constructing the floor of reinforced concrete slabs between I-beams for the U. S. Post Office Building at Huntington, W. Va., in 1905. The centers consist essentially of the pieces A (2x4 ins. for spans not exceeding 6 ft.) and the 2x3-in. triggers B, which rest on the lower flanges of the floor beams and thus support the forms. The trigger is secured at one end to the piece A by a 1x3-in. cleat C and at the other end by 1x3-in. cleats D on either side of A, which serve also as supports for the batter boards E. The six-penny nail F is but partly driven and it is to be drawn before removing the forms. When the supports of the beams are not fireproofed the cleats D extend to the bottom of the trigger B, but otherwise one cleat extends lower to secure the cross-strip G. To remove the forms, draw the partly driven nail F; knock off the strip G or loosen it enough to draw the nails in B; pull the triggers on one beam, and the forms will drop. If the soffit board H is used it is necessary first to remove the strip G. For larger beams use the spacing blocks H as shown; for smaller beams omit the trigger B and extend A to rest on the flange of the beam, then to remove the form A must be cut preferably near the beam.

No complete records of the cost of these forms were obtained, but the following partial information is furnished by Mr. Etherton; "Considering a panel 6 ft. span by 19 ft. long on 15-in. I-beams, the lumber consisting of 1-in. boards supported by 2x4-in. cross-pieces on 2x3-in. triggers spread 3 ft. on centers, soffit of beams not fireproofed, it required one carpenter five hours at 30 cts. per hour to complete the panel. Figuring from this alone I should say that 10 cts. per sq. yd. is a fair estimate for carpenter work. In working over the forms for another floor the 1-in. boards require more time to handle and I should say that the saving in cost of work over the first floor would be not over 2 cts. per sq. yd. Two laborers moved their scaffolding and took down the forms from three completed panels of 13 sq. yds. each in one hour. Smaller panels require a longer time per yard. Counting for the proper piling of lumber I should allow one hour for one man to take down the forms for a 13-sq. yd. panel when conditions are the best. We contracted with two laborers to remove the forms from the third floor and roof and pile them in good shape on the ground just outside of the building for an amount averaging about 4½ cts. per sq. yd., and the men made but small wages on the contract. The lumber was used on three floors and the roof, and the best of the 1-in. boards and all of the 2x4-in. and 2x3-in. stuff were used on a second job. For a safe estimate based on the data secured I should figure the cost of labor and materials for a three- or four-story building about as follows:

	Per sq. yd.
Lumber at $20 per thousand........	28 cts.
Carpenter work at 30 cts per hour..	10 cts.
Labor tearing down at 15 cts per hour	4 cts.
Total per square yard............	42 cts.

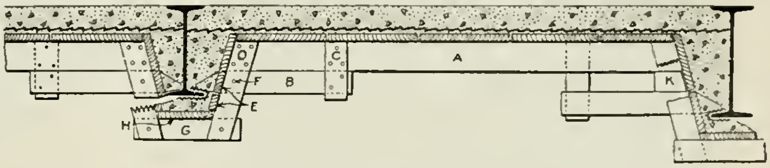


Fig. 1.—Center for Concrete and I-beam Floor.

The Ohio Board of Equalization for Railroad Property has concluded its work as to steam railroads. According to the appraisements approved the total of the valuation of railroad property in the state for taxation is fixed at $153,022,132, an increase of $4,961,803 over last year's valuation.

Florida East Coast Railway Extension

By Howard Egleston.*

I—GENERAL SITUATION

The recent suspension of work on the Florida East Coast Railway's Key West extension gives good occasion for a review of the work done and an account of the work that must be executed in order to complete the line.

Beginning at Homestead, the track is completed and in good order through the Everglades to Jewfish Creek (20 miles), down Key Largo to Tavernier Creek (18 miles), down Plantation Key and Upper Maticumbe (11 miles); in all, 49 miles. Passenger trains run over the line to this point on regular schedule, and, with the exception of trestles between Plantation Key and Upper Maticumbe, where solid stone fills are to be made, the roadbed is in a condition to compare very favorably with the best roads in the country.

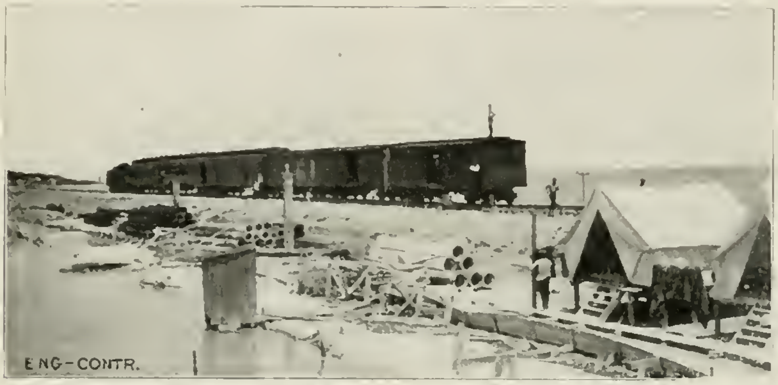


Fig. 1—First Passenger Train on F. E. C. Ry. Extension, Backing Down Onto Embankment at Central Supply Station, 49 Miles from Homestead.

Below Upper Maticumbe the track is completed for six miles to the lower end of Lower Maticumbe, but is only used for construction purposes. The opening between Lower Maticumbe and Long Key is four miles wide, an embankment has been thrown up for about half this distance, the balance of the way the track will be carried on trestles and about 2,000 ft. of the trestlework is completed and work is now progressing on the 8,000-foot trestle between the two curves of the reverse curve the road makes between these two islands. Across the length of Long Key (about 4 miles) a temporary grade has been constructed on which rails can be laid at any time.

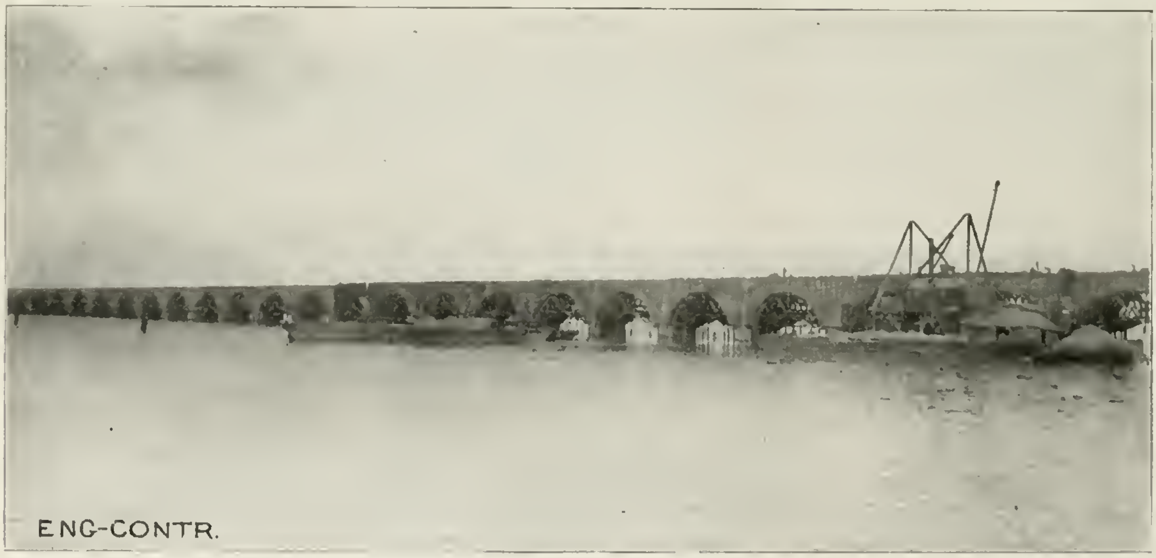


Fig. 2—Long Key Viaduct, End of Completed Work.

This brings us to the Long Key Viaduct, thus far the "Piece de resistance" of the work. Of the 180 arches originally planned for this viaduct, one hundred had been completed on Aug. 1, 1907, and the work was proceeding at the rate of three or four arches per week. (It has been the aim of those in charge of this work to average an arch per day, but this has never been accomplished, for the work done during the current year, working day and night shifts, it has taken on an average 35 hours for each arch.) Under the original plan, there would be only 80 arches to finish and at the present rate these should have been finished by the end of this year.

Under the original plan of construction the road is carried from the end of the concrete viaduct to Grassy Key, a distance of 20,100 ft., on a dirt embankment. At its juncture with the viaduct, this would have to be 31 ft. high. As experience has now demonstrated the impracticability of doing this work as originally designed, attention has been for some time given to devising a plan for getting down to a lower level. The first idea was to gradually reduce the height of the last arches of the viaduct, but the plan now favored is to add forty-four arches to the original number, thus adding about half a mile to the length of the viaduct; these last arches will each be slightly reduced in height, causing the grade on top to descend at the rate of 0.3 ft. per 100 ft.

Nothing has been done on this earth "fill" of nearly four miles, but on Grassy Key the roadbed is practically finished, as it is also on the five Crawl Keys and on Key Vaca and Knight's Key. Some work remains to be done in filling in the channels between these keys, and it is simple work and can be done in a short time.

At Knight's Key Channel we come to the first difficult work on the line. The water here is deep and entirely exposed to the Atlantic swell, and to all storms. At Long Key the reef which forms the outer side of Hawk Channel breaks all the Atlantic "rollers" and the water between the reef and the shore is never rough. So that, except in severe storms, the water in which the Long Key Viaduct is being constructed is quiet as an inland lake. But at Knight's Key this outer reef has disappeared, and the waters of the Atlantic break upon the site of the future viaduct without hindrance. The channel at Knight's Key requires a concrete viaduct or bridge of some sort 7,300 ft. long. This begins on the shore of Knight's Key and ends near Pigeon Key. From the end of this viaduct the road is to be continued on an earth embankment for about half a mile, crossing Duck Key and joining onto a viaduct 7,800 ft. long, which is to cross Moser Channel, thence by earth embank-

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*Chattanooga, Tenn.

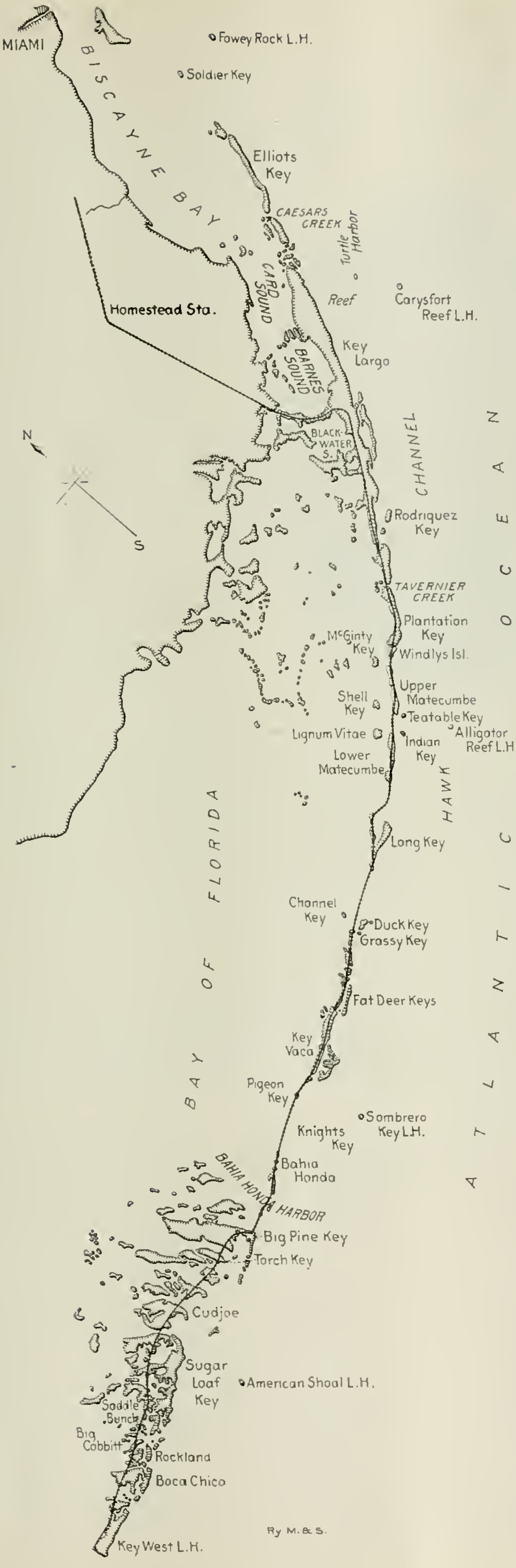

Fig. 3. Route of Key West Extension of Florida East Coast Ry.

ment to Little Duck Key. This piece of work between Knight's Key and Little Duck Key, a distance of 36,000 ft., I consider by far the most difficult on the line. It is the only point where the expression "a railroad over the ocean" applies. Looking west from Knight's Key in the direction the road is to take, one can see nothing but water, the islands to which the road runs rise only a foot or two above the ocean, and have little vegetation on them, so that at the distance they are away—nearly seven miles—they are visible only to a practiced eye and with the aid of a marine glass. To the north as well as to the south, nothing but water is in sight, no shelter from storms coming from any direction.

Continuing west, the line will pass over Missouri and Ohio Keys, to and over Bahia Honda Key, in all, say 3.9 miles to the Bahia Honda Viaduct, 4,950 ft. long, crossing water 25 ft. in some places, and over 10 ft. deep for 3,000 out of the 4,950 ft. of its length. The work here will be in deeper water, and more exposed than at Knight's Key, but it can be pushed out from each side of the channel, the work thus being at no time more than a half a mile from shore. After crossing Bahia Honda Channel the line passes over the three West Summerland Keys, a distance of 5,800 ft., and across Spanish Harbor Channel, 6,100 ft., to Big Pine Key, where the roadbed has been completed across the island, a distance of 3.4 miles. Between Big Pine Key and Torch Key runs Pine Channel, just one mile wide and varying in depth from 3 to 6 ft. Nothing has been done to this and the work, if done as originally planned, will be slow and costly, as there is practically no loose material for filling. This will necessitate drilling and blasting the coral rock so that the dredges can handle it. The roadbed on Torch and Ramrod Keys is complete and the fill between the two keys is about one-half done. On Summerland, Cudjoe and Sugar Loaf Keys the roadbed is practically completed, but the waterways between, about two miles, remains to be filled in. From Sugar Loaf Key into Key West, the embankment is complete with the exception of a small fill between Saddle Bunch and Big Coppitt, one between East Rockland and Boca Chica and a mile and a quarter fill between Boca Chica and Stock Island. To sum up, the condition of the work on August 1st was as follows:

Forty-nine miles of road completed and in operation; 45.5 miles roadbed finished ready for track, and 31 miles of viaducts, bridges and embankment, through water, remaining to be done.

Thus far no work of more than ordinary difficulty has been encountered. Most of the work done consists of grading on almost level ground, the embankment being in no case over 9 ft. high and in general, not exceeding 3 or 4 ft.

This would seem to be a very small

showing for over two years' work with unlimited funds to use. In another article I will describe methods used on this work and we may be able to understand why no greater progress has been made and why all the most difficult work remains to be done.

David E. Evans.

Mr. David E. Evans, of Baltimore, one of the most prominent engineers and contractors of the South, died at a hospital in that city after an operation for peritonitis. Mr. Evans was a self-made man of bright intellect and of wonderful energy. He was identified in the various industries in the South and had assisted greatly in the upbuilding of that section.

David E. Evans was born at Portypridd, Wales, on November 15, 1849. His father, Evan Evans, was a railway iron worker. Young Evans was educated in private schools, and was then apprenticed to learn the trade of engineer and machinist. At the age of 20, he was made master mechanic of the Taff Vale Iron Works of his native town. He afterwards became the chief engineer of the Cynmeer Steam Coal Colliers, then superintendent for Llewellyn and Cubitt, Engineers and Machinists, in South Wales. During the Franco-Prussian War Mr. Evans served as 2nd engineer on the S. S. English Lizzie and ran the blockade in the River Elbe.

In 1880 he came to this country, entering the employ of the Brush Electric Light Co., at Cleveland. Within a few months he was sent out as an engineer and electrician on the road in charge of the installation of electric light plants. In this capacity he installed the first plant ever used in Chicago, at the Palmer House, and also the first plants erected at Rochester, Auburn and Albany, N. Y. In 1882 he was sent to Baltimore as superintendent and chief engineer of the Brush Co. In 1888 he became superintendent of the Baxter Electric Motor Co., of Baltimore. In this manner he was brought into the construction field, as he realized that the future power to be used for the street car lines of our cities would be electricity.

Accordingly in 1891 he organized the firm of David E. Evans & Co., engineers and contractors, and engaged in the general contracting business, giving especial attention to the building of electric lines. His company did the overhead work as well as the construction of the tracks. In this connection he carried out contracts for 80% of the original electric roads of Baltimore, and built many lines in the South, besides erecting electric light plants in various cities and towns, acting also as advisory engineer to some cities. His company took the first contract for laying electrical conduits in the South. They also built such structures as the Mt. Royal Pumping Station in Baltimore and the Gay street car barn of reinforced concrete.

David E. Evans.

Mr. Evans was the organizer and president of the Southern Asphalt Paving Co., and laid pavements in numerous southern cities. This company was absorbed by the Barber Asphalt Co.

In 1899, Mr. Evans, associated with Mr. Geo. R. Webb, organized the Maryland Telephone Co. and later the Baltimore Electric Co., and the Wilmington Light, Power and Telephone Co. The plants of these companies were erected under his personal supervision.

Mr. Evans' death came when he was in his prime, at a time when he was engaged in numerous enterprises. Associated with him in the contracting business were his son, Robert W. Evans, and his son-in-law, Howard E. Cook. He was a director in a number of companies, vice-president of the Old Town National Bank of Baltimore, and president of the Maryland Telephone Co. and the Baltimore Electric Light Co.

Mr. Evans was among the first contractors to have his name enrolled as a charter member of the American Society of Engineering Contractors, a society in which he had expressed a deep interest. It would seem a fitting tribute to this able man that, upon the organization of the American Society of Engineering Contractors, this fall, the first obituary resolutions of the society be inscribed to the memory of David E. Evans.

The Collapse During Construction of the Quebec Bridge.

Some 800 ft. of the completed portion of the 1,800-ft. cantilever span of the new railway bridge across the St. Lawrence river about six miles above Quebec, Canada, collapsed on Aug. 29, killing 84 workmen. The collapsed portion of the structure comprised the south cantilever arm 562½ ft. long and some 200 ft. of the adjacent suspended span which had so far been erected. At the time of this writing no explanation has been offered as to the cause of the failure. The work was in the hands of the contractors, the Phoenix Bridge Co., of Phoenixville, Pa., at the time of the failure. It was being done for the Quebec Bridge & Railway Co., with Mr. E. A. Hoare as Chief Engineer and the veteran American bridge engineer, Mr. Theodore Cooper, M. Am. Soc. C. E., as Consulting Engineer.

The new Quebec bridge is located about

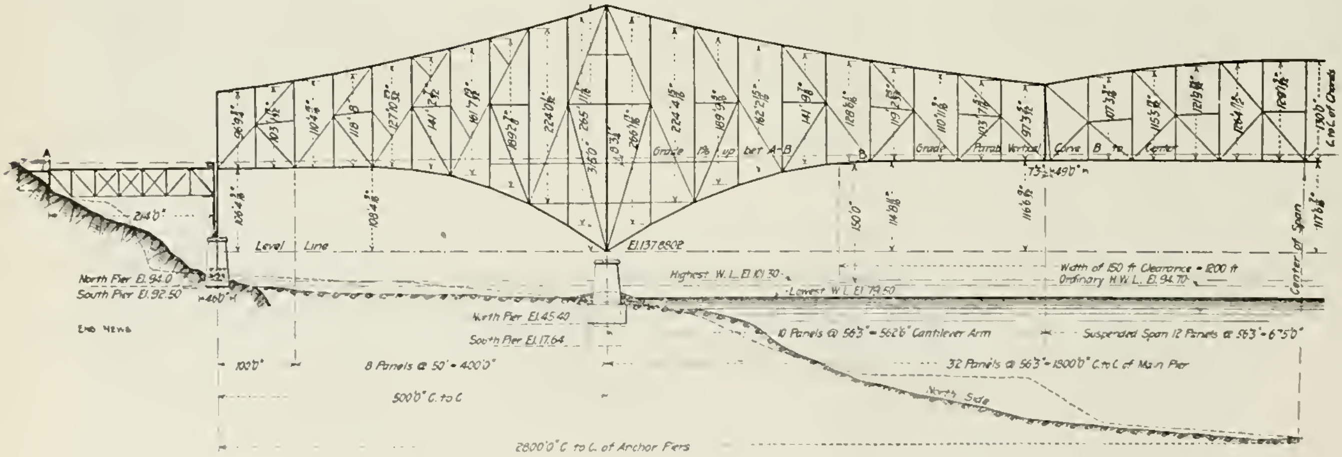

Diagram Half Elevation of Quebec Bridge.

six miles above the city of Quebec, Canada, about 165 miles below Montreal and some 500 miles from the sea. It was designed for both highway and railway traffic. The accompanying diagram elevation reproduced from "Engineering News" shows the general outline and main dimensions of the structure. The cantilever structure proper is 2,800 ft. c. to c. of anchor piers and to this are to be added the two 214-ft. approach spans making a total span length of 3,228 ft. The bridge is designed to carry between trusses two railway tracks, two trolley tracks and two roadways and outside of trusses two sidewalks.

Erection was begun in July, 1905. The shore arm of the cantilever was erected by a traveler on false works and the river arm and suspended span were being erected without falseworks at the time of the collapse.

The Quebec bridge had the largest single span of any bridge in the world. Its river span was 1,800 ft. between end piers, or 90 ft. longer than the longest spans of the Forth Bridge in Scotland and 200 ft. longer than the river span of the Williamsburg suspension bridge across the East river at New York city.

BOOK REVIEWS.

A Book of Instructions to Inspectors on Concrete Work.

INSTRUCTIONS TO INSPECTORS ON REINFORCED CONCRETE CONSTRUCTION AND CONCRETE DATA. By Geo. P. Carver. Payson Pub. Co., Beverly, Mass. Boards, 4x6½ ins.; pp. 79; illustrated. 35 cts.

The contents of this small volume divide themselves into three parts: (1) The sets of instructions to inspectors; (2) a collection of miscellaneous notes on concrete, and (3) a reprint of an article by Mr. E. P. Goodrich, M. Am. Soc. C. E., which appeared in a recent issue of the "Engineering Record." Altogether the instructions to inspectors comprise eight pages or eleven pages including the reprinted specifications for cement of the American Society for Testing Materials. It is obvious that no very comprehensive or elaborate instructions can be given in this limited space and while what the author says is good it is not worked out in the detail and with the explanation and illustration in which it should be worked out to be of wide value. In the second part of the book we find short sections on proportioning and mixing concrete, waterproofing, depositing concrete under water, concrete piles, concrete chimneys, tables of safe loads for columns, and several sections on costs of concrete, forms, reinforcement, building blocks and arch bridges. The sections on costs, while nominally of most interest, appear to be mostly estimates and general assertions without quoted authority. Regarding the third part—Mr. Goodrich's paper—it is as its title indicates, "Hints on the Design and Execution of Reinforced Concrete Works," giving explicitly the conclusions of an engineer of considerable experience in reinforced concrete work and, therefore, conclusions bound to be instructive and useful. It cannot be said that the book as a whole is called for by any vacancy in the field of concrete literature, except perhaps in the section on instructions to inspectors and here the author has to our mind fallen far short of the possibilities.

A Book of Plans for Mill Construction.

DETAILS OF MILL CONSTRUCTION. By Hawley Winchester Morton. Bates & Guild Co., Boston, Mass. Cloth, 9½x12 ins.; pp. 2 text, 25 plates; $2.

This is essentially a book of plans, the two pages of text being merely introductory to and in explanation of the plates that follow. These plates give dimensioned details of "mill construction" buildings taken either from work actually constructed or from actual measurements. They comprise seven plates of cast-iron details, one of wrought-iron details, four of door details, one of window details, four of framing details, two of stair details, and one each of cornice, saw tooth skylight, bath chute and water closet details. The plans can be recommended as useful and instructive.

A Valuable Reference Book.

HENDRICKS' COMMERCIAL REGISTER Samuel E. Hendricks Co., New York, N. Y. Cloth, 7½x10¼ ins.; pp. 1224; $10.

No more valuable compendium of names and addresses is available than is had in this book. To give figures there are 350,000 names and addresses of persons and firms engaged in or connected with the architectural, mechanical, engineering, contracting, electrical, iron, steel, mining, mill, quarrying and other industries. These names and addresses are classified according to occupation or business and also geographically by states and cities. Altogether there are upwards of 15,000 business classifications.

An Important Treatise on Wall and Bin Design.

THE DESIGN OF WALLS, BINS AND GRAIN ELEVATORS. By Milo S. Ketchum, Dean of the College of Engineering University of Colorado. The Engineering News Pub. Co., New York, N. Y. Cloth, 6x9 ins.; pp. 393; illustrated; $4 net.

In prefacing his book the author very truly says that the need of a systematic treatise on bin design has long been felt. His book is an attempt to produce this needed treatise and all things considered the attempt has been remarkably successful. There remains a great deal to be learned of the action of granular materials and until much more is known there will always be conflicting opinion and theories as to whether these materials actually give the pressures determined by assumption and calculation. This means that the assumptions of any writer will have to bear attack and the work of Mr. Ketchum cannot expect to be free of this danger. If we may judge from the wording of his preface, Mr. Ketchum does not anticipate this freedom.

Turning now to the contents of the book, the author divides them into three parts: Part I, comprising an introduction and seven chapters on retaining walls; Part II, being devoted to bins and containing seven chapters, and Part III, on grain bins and elevators, containing six chapters. The plan of treatment for each part is to present a discussion of the stresses and principles of design, follow this with examples taken from actual practice and conclude with general data on costs of construction.

The volume begins with the section on retaining walls, it being considered by the author that a thorough knowledge of the theory of this structure is essential to a correct understanding of the theory of pressure in bins. An introductory chapter defines briefly the theories of Rankine, Weyrauch, Coulomb, Cain and Trautwine and gives the nomenclature used in the succeeding discussion. Rankine's and Coulomb's theories are then presented in detail in Chapters I and II. Chapter III discusses the design of masonry walls and in Chapter IV the author presents a full discussion of reinforced concrete retaining wall design illustrated by several problems. Chapter V summarizes the experiments made on retaining walls by Leygue, Baker, Goodrich and others and draws conclusions from them. A number of well selected examples on retaining walls illustrated by detail drawings is given in Chapter VI. Chapter VII contains about eight pages of data on the cost of retaining walls, taken from various sources including Gillette's "Hand Book of Cost Data" and Mr. James W. Beardsley's papers on the retaining wall work for the Chicago Drainage Canal.

Part II opens with a chapter describing and illustrating the common types of coal and ore bins. Stresses in bins are then discussed in detail in a chapter of some 36 pages, then follows a short chapter on experiments on pressures on bin walls and another and longer chapter on design of bins. Chapter XII gives examples and details of steel and reinforced concrete bins and Chapter XIII closes the discussion with statements of the cost of bin construction. This section of the book is profusely illustrated with diagrams, stress sheets and shop drawings of details. There are also many tables of data for use in bin calculations.

The same line of treatment is followed in Part III on grain bins and elevators as is followed in Part II and outlined above. Types of bins, stresses, experimental, investigations, design, examples of construction and costs are taken up in the order named. In this section also the author makes profuse use of illustrations and tables.

The publisher's work on the book is generally good both in the matter of typography and in that of illustration. There is an adequate index.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0329. **Engineering Instruments.**—R. Seelig & Son Co., Chicago, Ill.

This is a well written descriptive catalog of the select line of transits, levels, rods, tapes, tripods, barometers, compasses and their fittings manufactured by the firm named. There are sections describing the care and adjustment of instruments. Among the instruments shown and worthy of special mention is a patent improved telescope eye level for which several advantages are claimed and which is described in detail.

No. 0330. **Road Rollers.**—The Port Huron Co., Port Huron, Mich.

This pamphlet gives some brief and interesting notes on the history of macadam roads and describes and illustrates the various patterns of the "Powerful" roller manufactured by the firm named. Sectional drawings are shown of the boiler and cylinders and each of the other mechanical parts is described in detail. Methods of road-making, using the "Powerful" roller, are described.

No. 0331. **Grinding Wheels and Machinery.**—Norton Co., Worcester, Mass.

This catalog besides giving the dimensions, shapes and prices of the large line of grinding wheels made by the firm named, contains a large amount of useful information regarding the composition, manufacture, use and care of such wheels. Complete grinding machines are also listed and described. The catalog is an excellent one.

No. 0332. **Electrical Appliances and Machinery.**—General Electric Co., Schenectady, N. Y.

The bulletins included in this list describes and illustrate Tungsten lamps for street series lighting, manhole, fire boxes, circuit breakers, insulated plant switchboard panels with fuses, electric hoists and engine type continuous current generators. In the bulletin on electric hoists the company describes and illustrates single and double-drum hoists, with single and double motors, operated by continuous current and made in a variety of sizes and patterns.

No. 0333. **Air Compressors.**—The American Well Works, Aurora, Ill.

The air compressors described and illustrated in this bulletin are of types designed particularly for the operation of air lift pumping plants. They comprise both vertical and horizontal simple and duplex compressors. Dimensions, weights and capacities of the several machines are given.

No. 0334. **Concrete Mixer.**—The Knickerbocker Co., Jackson, Mich.

The mixer described in this catalog is known as the Coltrin mixer and is of the continuous type, consisting of a long cylindrical shell in which a set of screw blocks mounted on an axial driving shaft is mounted.

No. 0335. **Simplex Concrete Piles.**—The Foundation Co., New York, N. Y.

The standard Simplex pile construction consists in driving a steel shell with a cast iron or concrete point and filling this shell with concrete gradually withdrawing the shell as the concrete is placed. This pamphlet describes the construction in detail, shows various examples of work done and discusses evils. It also describes the special piles known as the Simplex molded pile, Simplex wharf, Simplex jointed pile and other special piles.

No. 0336. **Reinforced Concrete.**—Trussed Concrete Steel Co., Detroit, Mich.

This pamphlet is written to present the advantages of reinforced concrete for hotel, apartment house and residence construction. It illustrates and describes a number of such structures and discusses speed of erection, noiseless construction, wind and dust proof and sanitary qualities, adaptability to architectural decorations, and fireproofness.

No. 0337. **Contractors' Tents.**—Zittlosen Mfg. Co., St. Louis, Mo.

This company manufactures a complete line of canvas goods, making a specialty of contractors' tents, carpenters' and mechanics' aprons, leggings, jumpers and overalls. The tents include all sizes and types and this catalog gives sizes, capacities, prices, etc.

No. 0338. **Oil Engines.**—De La Vergne Machine Co., New York, N. Y.

This pamphlet describes and illustrates the construction of the Hornsby-Akroyd oil engine and shows its application to power plants, electric lighting stations, pumping plants, refrigerating plants, lighthouses and other uses. The descriptions and illustrations are excellent and give a clear idea of the engine and its application.

No. 0339. **Elevating Grader.**—Russel Grader Manufacturing Co., Minneapolis, Minn.

The elevating grader described in this catalog has the elevating belt operated by a gasoline engine mounted on the frame, thus reducing the number of teams required to operate the machine. It is operated with chain drive, has extension tires for soft ground and is operated by two men, a driver and an operator.

No. 0340. **Concrete Mixers.**—Eureka Machine Co., Jackson, Mich.

The Eureka mixer described in this pamphlet is of the continuous trough type with automatic charging apparatus, and is especially adapted to sidewalk and paving work.

No. 0341. **Filters.**—Philadelphia Water Purification Co., Philadelphia, Pa.

The Hungerford-Elfreth filter described in this pamphlet is of the mechanical type and is intended particularly for private houses, hotels, factories and institutional buildings, though made also for municipal water supply. The several types of filter are described and illustrated and their care and operation explained.

No. 0342. **Locomotives and Cars.**—Hicks Locomotive & Car Works, Chicago, Ill.

This book contains a brief history and description of the Hicks works and a large number of handsome illustrations of locomotives and cars turned out during the last year.

No. 0343. **Twisted Steel Reinforcement.**—Buffalo Steel Co., Tonawanda, N. Y.

This circular illustrates, gives sizes and discusses the advantages of twisted high carbon steel bars for concrete reinforcement. The company named makes a specialty of keeping in stock redy for immediate shipment all sizes of these bars.

No. 0334. **Road Machinery.**—Indiana Road Machine Co., Fort Wayne, Ind.

This is a good example of descriptive catalog work. Each machine is illustrated and described clearly and in sufficient detail to explain its construction and operation and to bring out the advantages claimed. The line includes road machines, rock crushers, road rollers, portable crushing plants and stone bins, screens, elevators, portable engines, wheeled and drag scrapers, plows, dump cars and wagons, rock drills, and elevating graders.

Personal.

Mr. William T. Blunt, M. Am. Soc. C. E., has resigned as engineer for G. H. Breyman & Bros., Contractors, Boston, Mass.

Mr. Hiram J. Slifer has opened an office as consulting civil engineer, specializing in steam railway practice at 37-43 Wall St., New York city.

Mr. Alex. E. Kastl, 124 Walnut street, Clinton, Mass., has been appointed Assistant Engineer in charge of section by the Board of Water Supply of New York City.

Mr. William De Nyse of Long Branch, N. J., died at his home Aug. 21, aged 52 years. Mr. Wyse was a civil engineer and was prominent in New Jersey road building.

Mr. H. R. Mauby, heretofore Assistant Engineer of the Nashville Terminal Co., Nashville, Tenn., has been appointed Engineer, succeeding Mr. E. G. Holladay, resigned.

Mr. F. B. Maltby, M. Am. Soc. C. E., Principal Assistant Engineer Panama Canal, has resigned to become Chief Engineer for Dodge & Day, engineers and constructors of Philadelphia, Pa.

Prof. E. B. Homer, for the past six years Director of the Rhode Island School of Design, has resigned that position and has become associated with Clarke & Howe, Architects, of Providence, R. I.

Mr. Avery P. Eckert has been appointed General Sales Manager of the Duplex Metals Co., manufacturers of Monnot copper-clad products. Mr. Eckert's headquarters will be at 208 5th avenue, New York City.

Mr. A. W. Galbreath of the Engineering Department of the Vandalia R. R., heretofore located at Logansport, Ind., has been transferred to the St. Louis Division of the above road, with headquarters at Terre Haute, Ind.

Prof. L. G. Carpenter, Director of the State Agricultural College of Colorado, Fort Collins, Colo., has been retained by the Provincial Government of British Columbia to investigate various engineering problems, particularly those intended to furnish relief from difficulties due to existing water conditions.

Mr. Bernard J. McGrann, a well known contractor, died August 28 at his home in Lancaster, Pa., aged 70 years. He built the Catawissa extension to Williamsport, the bridge across the Delaware River at Yardleyville and the railroad from Pittsburg to Youngstown to connect with the Vanderbilt system.

Mr. T. K. Legaré, formerly Assistant City Engineer of Columbia, S. C., and Mr. A. E. Legaré, formerly in charge of electric railway surveys for the South Carolina Public Service Corporation, have opened offices at 1422 Main street, Columbia, S. C., where they will engage in practice as Consulting Civil Engineers.

Mr. Wilbur J. Watson has resigned as Bridge Engineer of the Osborn Engineering Co. and has opened offices in the Citizens' building, Cleveland, O., where he will engage in private practice as a specialist in design, inspection and construction of bridges, buildings and special structures of steel and reinforced concrete.

Mr. H. W. Durham has resigned his position as Resident Engineer at Panama for the Isthmian Canal Commission and has accepted a position with Wm. Barclay Parsons of New York City. Mr. Durham will be in charge of preliminary work on the Cape Cod Canal, Massachusetts, and will have his headquarters at Sandwich, Mass.

Col. Amos Stickney, Corps of Engineers, was retired from the army on August 28, with the rank of Brigadier-General, he having reached the age limit. Colonel Stickney was born in Missouri and appointed from New York. After the civil war, in which he served in 1864 and 1865, he was resident of the Mississippi River Commission and of the Missouri River Commission. He was also in charge of river and harbor improvements work at New York. On June 4 he retired as engineer officer of the Atlantic division.

Prof. E. R. Dewsnap has been appointed Professor of Railroad Administration and Management at the University of Illinois. Prof. Dewsnap, born in England of American parents, was educated at the University of Manchester and at the Royal Technical College of Manchester. After graduation he spent considerable time studying the operation, construction and management of railroads in the United Kingdom, in France, and in Germany, and was for a time an official on an English railway. Three years ago he came to take charge of the railroad course at the University of Chicago.

Mr. Nelson A. Sager, Engineer in Charge of the Intercepting Sewer Division of the City of Chicago, Ill., died August 30, at his home in that city, aged 53 years. Mr. Sager was born in Port Hope, Ont., and came to Chicago fifteen years ago. He had been connected with the intercepting sewer department for the past twelve years; previous to that he was engaged in railroad and other engineering works, among which the construction of the World's Columbian Exposition in 1893 may be mentioned. At the time of his death Mr. Sager was in full charge of the Intercepting Sewer Division of the City of Chicago.

Mr. John C. Ostrup, M. Am. Soc. C. E., has been anppointed to fill the Chair of Structural Engineering at the Stevens Institute of Technology, Hoboken, N. J. Prof. Ostrup is a graduate of the Polytechnic School in Copenhagen, and later took a post graduate course at the Chicago Engineering School, and has had a large and varied experience in important work extending over 17 years. He was for five years in charge of the office work and design of the Lake Street, the Northwestern and the Union Elevated railways of Chicago during their construction, and afterwards Designing Engineer of the Boston Elevated R. R. during its building. Upon its completion he went into private practice for four years and has since for the past two years designed many important structures and bridges for the American Bridge Co. in New York.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Bids Open.		See Issue.
Sept. 4.	Rahway, N. J	Aug. 28
Sept. 4.	Vicksburg, Miss	Aug. 28
Sept. 4.	Winnipeg, Man	Aug. 28
Sept. 4.	Glasgow, Mont	July 31
Sept. 4.	Columbus, O.	Aug. 21
Sept. 4.	Smith's Landing. N. J	Sept. 4
Sept. 4.	Bynum, Mont.	Sept. 4
Sept. 4.	Warrensburg, Mo.	Sept. 4
Sept. 5.	Eaton, O	Aug. 28
Sept. 5.	Ottawa, Ont.	Sept. 4
Sept. 5.	Long Island City, L. I., N. Y.,	Sept. 4
Sept. 5.	Jefferson, Mo.	Sept. 4
Sept. 9.	Wichita, Kan	Aug. 28
Sept. 9.	Laurel Springs	Aug. 28
Sept. 9.	Paquemine, La	Aug. 14
Sept. 10.	Yo Semite, Cal	Aug. 28
Sept. 11.	Philadelphia, Pa.	Sept. 4
Sept. 13.	Lorain, O.	Sept. 4
Sept. 13.	Dunbar, Neb.	Sept. 4
Sept. 14.	Cleveland. O	Aug. 28
Sept. 16.	Adin, Cal	Aug. 28
Sept. 16.	Madera, Cal	Aug. 14
Sept. 18.	Houston, Texas	Sept. 4
Sept. 23.	Newark, O.	Sept. 4
Sept. 31.	Guthrie, Okla.	Sept. 4
Sept. 30.	Santiago, Chile	July 17
Oct. 15.	Dunrea, Man.	Sept. 4
Oct. 19.	Canton, China	Sept. 4

Buildings

Sept. 4.	New London, Conn	Aug. 28
Sept. 4.	Albany, N. Y	Aug. 28
Sept. 4.	Quincy, Mass	July 31
Sept. 5.	Evansville, Ind.	Aug. 7
Sept. 5.	Columbia, S. C	Aug. 28
Sept. 5.	Geneva, N. Y	Aug. 28
Sept. 5.	New York, N. Y	Sept. 4
Sept. 5.	Newcastle, Ind.	Sept. 4
Sept. 9.	Cleveland. O.	Aug. 21
Sept. 6.	Liberal, Kans.	Sept. 4
Sept. 9.	Roulette, N. D.	Sept. 4
Sept. 9.	Kingston, Ont.	Sept. 4
Sept. 9.	North Grosvenor Dale, Conn.,	Sept. 4
Sept 10.	Shrevesport, La	Aug. 28
Sept. 10.	Whitesboro, N. Y	Aug. 28
Sept. 10.	Kansas City, Mo.	Sept. 4
Sept. 10.	Forsyth, Ga.	Sept. 4
Sept. 11.	Eureka, Cal	Aug. 14
Sept. 11.	New York, N. Y.	Sept. 4
Sept. 12.	Marianna, Fla	Aug. 28
Sept. 12.	Rome, N. Y	Aug. 28
Sept. 12.	Fort Sam Houston, Tex	Sept. 4
Sept. 13.	Park Rapids, Minn.	Sept. 4
Sept. 13.	Chicago, Ill.	Sept. 4
Sept. 14.	Hudson, N. Y	Aug. 28
Sept. 14.	Washington, D. C.	Sept. 4
Sept. 15.	Owensville, Ind.	Sept. 4
Sept. 16.	Washington, D. C	Aug. 28
Sept. 16.	Pittsburg, Pa.	Aug. 7
Sept. 16.	Buffalo, N. Y	Aug. 7
Sept. 16.	Pullman, Wash.	Sept. 4
Sept. 17.	Lawrence, Kan	Aug. 28
Sept. 17.	San Francisco, Cal	Aug. 14
Sept. 19.	Muscatine, Ia	Aug. 14
Sept. 23.	Cedar Rapids, Ia	Aug. 14
Sept. 24.	Hamilton, O.	Aug. 21
Sept. 30.	Selma, Ala	Aug. 28
Oct. 1.	Eau Claire, Wis	Aug. 28
Oct. 1.	Pensacola, Fla.	Aug. 21
Oct. 1.	Indianapolis, Ind.	Sept. 4
Oct. 1.	Indianapolis, Ind.	Sept. 4
Oct. 7.	Baltimore, Md	Aug. 28

Roads and Streets.

Sept. 4.	Bloomington, Ind	Aug. 28
Sept. 4.	Providence, R. I	Aug. 28
Sept. 4.	Elmira, N. Y	Aug. 28
Sept. 4.	New York, N. Y	Aug. 28
Sept. 4.	Providence, R. I	Aug. 28
Sept. 4.	Buffalo, N. Y.	Sept. 4
Sept. 4.	Portsmouth, O.	Sept. 4
Sept. 5.	Carrollton, O	Aug. 28
Sept. 5.	New York, N. Y.	Sept. 4
Sept. 5.	Monroe, N. Y.	Sept. 4
Sept. 5.	Bergholtz, O.	Sept. 4
Sept. 5.	El Reno, Okla.	Sept. 4
Sept. 5.	Johnson City, Tenn.	Sept. 4
Sept. 5.	Mt. Vernon, Ind.	Sept. 4
Sept. 5.	Dallas, Texas	Sept. 4
Sept. 5.	Kansas City, Mo.	Sept. 4
Sept. 5.	Kansas City, Mo.	Sept. 4
Sept. 6.	Decatur, Ind	Aug. 28
Sept. 6.	Janesville, Wis.	Sept. 4
Sept. 6.	Mt. Vernon, Ind.	Sept. 4
Sept. 6.	Champaign, Ill.	Sept. 4
Sept. 6.	St. Paul, Minn.	Sept. 4
Sept. 6.	Bluffton, Ind.	Sept. 4
Sept. 6.	Indianapolis, Ind.	Sept. 4
Sept. 6.	Cumberland, Md.	Sept. 4
Sept. 6.	West Allis, Wis.	Sept. 4
Sept. 7.	Washington, Ind.	Sept. 4
Sept. 7.	Terre Haute, Ind.	Sept. 4
Sept. 9.	De Land, Fla.	Sept. 4
Sept. 9.	El Paso, Texas	Sept. 4
Sept. 9.	Chicago, Ill.	Sept. 4
Sept. 9.	La Porte, Ind.	Sept. 4
Sept. 10.	Cleveland Heights, O	Sept. 4
Sept. 11.	Bridgeton, N. J	Aug. 28
Sept. 11.	Cincinnati, O	Aug. 28
Sept. 11.	Cleveland, O.	Aug. 21
Sept. 11.	Cleveland, O.	Aug. 21
Sept. 12.	Cincinnati, O	Aug. 28
Sept. 12.	Silverton, O.	Sept. 4
Sept. 12.	Marietta, O.	Sept. 4
Sept. 13.	Des Moines, Ia	Aug. 28
Sept. 13.	Madison, Wis	Aug. 28
Sept. 13.	Cincinnati, O.	Sept. 4
Sept. 14.	St. Moultrie, S. C	Aug. 28
Sept. 16.	Euclid, O.	Sept. 4
Sept. 16.	St. Paul, Minn.	Sept. 4
Sept. 20.	Rockville, Ind	Aug. 28
Sept. 18.	Cincinnati, O.	Sept. 4
Sept. 20.	Frankfort, Ind.	Sept. 4
Sept. 24.	Lebanon, Ind.	Sept. 4

Sewers.

Sept. 4.	Beloit, Wis	Aug. 28
Sept. 5.	Sumter, S. C	Aug. 28
Sept. 5.	Monessen, Pa.	Aug. 21
Sept. 5.	New York, N. Y.	Sept. 4
Sept. 5.	Johnson City, Tenn.	Sept. 4
Sept. 5.	Cedar Rapids, Ia.	Sept. 4
Sept. 5.	Kansas City, Mo.	Sept. 4
Sept. 5.	Bozeman, Mont.	Sept. 4
Sept. 6.	Iowa City, Ia	Aug. 7
Sept. 6.	Olean, N. Y.	Sept. 4
Sept. 7.	Seattle, Wash.	Sept. 4
Sept. 9.	Bryant, S. D	Aug. 28
Sept. 9.	St. Paul, Minn.	Sept. 4
Sept. 11.	New Orleans, La	July 10
Sept. 11.	New York, N. Y.	Sept. 4
Sept. 11.	Hoboken, N. J.	Sept. 4
Sept. 11.	Philadelphia, Pa.	Sept. 4
Sept. 11.	Chicago, Ill.	Sept. 4
Sept. 13.	Des Moines, Ia	Aug. 28
Sept. 13.	Lake Mills, Wis.	Aug. 21
Sept. 16.	Linton, Ind.	Sept. 4
Sept. 16.	Chattanooga, Tenn.	Sept. 4
Sept. 16.	Canton, O.	Sept. 4
Sept. 17.	South Orange, N. J.	Sept. 4
Sept. 19.	Canton, Miss.	Sept. 4
Sept. 19.	Logus, Me.	Sept. 4

Water Supply.

Sept. 4.	New Orleans, La.	July 3
Sept. 4.	Cazenovia, N. Y.	Sept. 4
Sept. 5.	Bellevue, O	Aug. 28
Sept. 5.	Leesburg, O.	Sept. 4
Sept. 6.	Montreal, Que	Aug. 14
Sept. 7.	Pensacola, Fla.	Aug. 21
Sept. 9.	Orange, N. J	Aug. 28
Sept. 9.	Stambaugh, Mich.	Sept 4
Sept. 10.	Decorah, Ia.	Sept. 4
Sept. 14.	Norfolk, Va.	Aug. 21
Sept. 20.	Canon City, Colo.	Sept. 4
Sept. 27.	Washington, D. C.	Sept. 4

Miscellaneous.

Sept. 4.	Baltimore, Md.,	Disposition of Garbage,	Aug. 21
Sept. 9.	West Point, N. Y.,	Emplacements,	Aug. 28
Sept. 5.	Boston, Mass.,	Tunnel Work,	Sept. 4
Sept. 5.	Buffalo, N. Y.,	Pier Work,	Sept. 4
Sept. 10.	Philadelphia, Pa.,	Lighthouse Superstructure,	Aug. 28
Sept. 10.	Fairport, O.,	Breakwater,	Aug. 14
Sept. 10.	Cleveland, O.,	Breakwater,	Aug. 14
Sept. 10.	Bar Harbor, Me.,	Breakwater,	Aug. 21
Sept. 11.	Cincinnati, O.,	Dike and Dam,	Aug. 21
Sept. 12.	Millen, G. A.,	Electric Light and Water Plant,	Aug. 28
Sept. 14.	Napanoch, N. Y.,	Power House,	Sept. 4
Sept. 16.	Stockton, Cal.,	Bulkhead,	Aug. 28
Sept. 19.	Boston, Mass.,	Wrecking Work,	Sept. 4
Sept. 21.	Portsmouth, N. H.,	Power House,	Sept. 4
Sept. 26.	Fort Dupont, Delaware City, Del.	Freight Wharf,	Sept. 4
Sept. 30.	Washington, D. C.,	Search Light Outfit,	Aug. 7
Oct. 1.	Winnipeg, Man.,	Hydro-Electric Station,	Sept. 4
Oct 5.	Franklin Shoals, Ark.,	Lock and Dam,	Aug 7
Oct. 5.	Mobile, Ala.,	Locks and Dams,	Aug. 14
Oct. 5.	Franklin., Ark.,		Aug. 14
Oct. 5.	Vicksburg, Miss.,	Lock and Dam,	Aug. 14

Excavation, Earth and Rock.

Sept. 4.	Providence R. I.,	Dredging,	Aug. 7
Sept. 4.	Norfolk, Va.,	Dredging,	Aug. 14
Sept. 4.	Providence, R. I.,	Dredging,	Aug. 14
Sept. 4.	Woonsocket, S. D.,	Drainage Ditch,	Aug. 21
Sept. 5.	Seattle, Wash.,	Dredging,	Aug. 14
Sept. 5.	Plaquemine, La.	Earth Filling,	Sept 4
Sept. 6.	Boston, Mass.,	Dike Work,	Sept 4
Sept. 7.	Little Rock, Ark.,	Dredging, Concrete Conduit,	Aug 21
Sept. 7.	Washington, D. C.,	Dredging,	Aug 21
Sept. 7.	New London, Conn.,	Dredging,	Aug 21
Sept 9	Honolulu, T. H.,	Dredging,	Sept. 4
Sept 10.	Sibley, Ia.	Ditch Work,	July 31

Sept. 10. New Orleans, La., Dredging, Aug. 21
Sept. 10. Patton, Cal., Storm Water Channels, Aug. 28
Sept. 11. Bradley, Ark., Levee Work, Aug. 28
Sept 11 12 Estherville, Ia., Ditch Work, Sept. 4
Sept. 12. Rich, Ill. Drainage Ditches, Aug. 28
Sept. 14. Moultrieville, S. C., Dredging, Filling In., Aug. 28
Sept. 16. Plaquemine, La., Earth Filling, Sept. 4
Sept. 16. Newport, R. I., Drill Ground, Sept. 4
Sept. 17 Clayton, Mich., Drain, Sept. 4
Sept. 18. Seattle, Wash., Dredging, Sept. 4
Sept. 19. Gardner, Me., Dredging, Aug. 28
Sept. 30. New York, N. Y., Dredging and Rock Removal, Sept. 4
Oct. 7. Detroit, Mich., Excavating, Sept. 4
Oct. 8. Detroit, Mich., Dredging, Sept. 4
Oct. 10. Peterboro, Ont., Canal, Sept. 4

Materials, Machines, Supplies, Tools Etc

Sept. 5. River Falls, Wis., Fire Hose, Aug. 21
Sept, 8. Louisville, Ky., Pumping Engines, July 31
Sept. 9. New York, N. Y., Lumber, Pipe-Fittings, etc., Sept. 4
Sept. 10. Rock Island, Ill., Lumber, Sept. 4
Sept. 10. Buffalo, N. Y., Pumps, Sept. 4
Sept. 12. Jefferson Barracks, Mo., Boilers, Sept. 4
Sept. 13. Lawrenceburg, Tenn., Machinery, Sept. 4
Sept. 14. Manila, P. I., Valves, Gates, July 31
Sept. 14. New York, N. Y., Motor Generator Sets, Aug. 28
Sept. 17. New Orleans, La., Lumber and Piling, Sept. 4
Sept. 25. Washington, D. C., Machinery, Sept. 4
Sept. 30. Cincinnati, O., Dredging, Sept. 4
Sept. 30. Los Angeles, Cal., Water Pipe and Pumping Machinery, Sept. 4
Sept. 30. West Point, N. Y. Gas and Electric Fixtures, Sept. 4
Oct. 15. Honolulu, T. H., Materials, Sept. 4

BIDS ASKED.

Bridges.

Items Arranged Alphabetically by States.

Jefferson, Mo.—Bids are asked until Sept. 5 for constructing a steel highway bridge over the North Moreau Creek, at Rock House Ford. The structure is to consist of one through steel truss span 177 ft. in length and six approach spans each 30 ft. in length. E. F. C. Harding is County Commissioner.

Warrenburg, Mo.—Bids are asked by David Mohler, County Bridge and Road Commissioner, until Sept. 4, for the construction of various steel bridges.

Byrum, Mont.—Bids are asked by the Board of County Commissioners until 10 a. m., Sept. 4, for the construction of a bridge.

Dunbar, Neb.—Bids are asked by the Board of County Commissioners until 2 o'clock noon, Sept. 13, for the erection of a 50 ft. steel bridge.

Smith's Landing, N. J.—Bids are asked by the Bridge Commission, Frank Enderlin, Chmn. of the County Board of Chosen Freeholders, until 11:30 a. m., Sept. 4, for constructing 2 highway bridges.

Long Island City, L. I., N. Y.—Bids are asked by J. W. Stevenson, Commissioner Bridges, until Sept. 5, for construction of the steel and masoury approach to the Blackwell's Island bridge in the Borough of Queens over the East River.

Lorain, O.—Bids are asked by the Board of County Commissioners, Charles Chandler, Clerk, until 1 p. m., Sept. 13, for constructing bridges.

Newark, O.—Bids are asked by the County Commissioners until Sept. 23 for constructing a 105 ft. span, riveted steel truss bridge.

Guthrie, Okla.—Bids are asked by the Board of County Commissioners until Sept. 31 for constructing a bridge on the Cimarron River in Dist. No. 31, Lawrie Township.

Philadelphio, Pa.—Bids are asked by George R. Stearns, Director Board Public Works, until 12 o'clock noon, Sept. 11, for the following bridges: At Belmont and Girard Aves., steel girder bridge, encased in concrete, 410 ft. long and 126 ft. wide, over Pennsylvania R. R.; appropriation $20,000 by the railroad and $65,000 by the city. At Columbia Ave., steel girder bridge, encased in concrete, 136 ft. long and 56 ft. wide, over Connecting railway; appropriation $35,000 by railroad and $17,500 by the city. Boulevard, bridge over P. U. & N. Y. R. R., re-enforced concrete arch bridge, 65 ft. long and 100 ft. wide; appropriation $45,000. Boulevard bridge over Tacony Creek and Ashdale St., concrete arch bridge, 3 spans, 80 ft. 2 inches each, width 100 ft.; appropriation $100,000.

Houston, Tex.—Bids are asked by the County Auditor until Sept. 18, for constructing a bridge over the San Jacinto River, near Humble. The bridge is to be 687 ft. in length and cost about $40,000.

Dunrea, Man.—Bids are asked until 12 o'clock noon, Oct. 15, for the construction of steel highway bridge across the Sowris River.

Ottawa, Ont.—Bids are asked by P. E. Ryan, Secretary Trancontinental Ry. Commission, until Sept. 5, for constructing superstructure and floor systems for bridges.

Canton, China.—Bids are asked by the Canton River Bridge Co., Ltd., Lau Chin Ting, Chmn., until Oct. 19, for constructing a steel cantilever and girder bridge, 1,102 ft. long, in the Front Reach, Canton, on site about 740 ft. west of the Dutchfolly Fort.

Buildings.

Items Arranged Alphabetically by States.

North Grosvenor Dale, Conn.—Bids are asked until Sept. 9 for the erection of the Tourtelotte Memorial High School, to be built at North Grosvenor Dale, Conn. McLean & Wright, 110 Tremont St., Boston, Mass., Architects.

Washington, D. C.—Bids are asked by the Bureau of Yards and Docks, Navy Dept., until 11 a. m., Sept. 14, for the construction of 3 brick buildings at the Naval Hospital Reservation.

Forsyth, Ga.—Bids are asked by the Building Commissioners and Revenues, J. S. Jossey, Chmn., until Sept. 10, for heating the court house.

Chicago, Ill.—Bids are asked by John J. Hanberg, Commissioner of Public Works, 221 City Hall, until 11 a. m., Sept. 13, for constructing superstructure of an engine house, together with foundations and superstructure for a connecting building at Lake View pumping station.

Indianapolis, Ind.—Bids are asked by Hiram Brown, Chmn. Building Committee, until Oct. 1, for the construction of a new Y. M. C. A. building on North Pennsylvania St. Estimated cost $100,000.

Indianapolis, Ind.—Bids are asked until Oct. 1 by the Building Committee of the Broadway M. E. Church for the construction of a stone veneer church Estimated cost $35,000.

Owensville, Ind.—Bids are asked until Sept. 15 by the Board of Trustees, M. E. Church, for erecting a church building. Estimated cost $10,000.

Newcastle, Ind.—Bids are asked by the Board of Trustees, Indiana Village for Epileptics, until Sept. 5, for erecting two cottages. W. S. Kaufman & Son, Richmond, Ind., are Architects.

Liberal, Kans.—Bids are asked by the Board of County Commissioners until Sept. 6 for erecting a court house. J. M. Smith, Hutchinson, Kans., is Architect.

Park Rapids, Minn.—Bids are asked by Rev. P. O'Meara, St. Peters Church, until Sept. 13, for erecting a brick church building. A. J. Blix, St. Cloud, Minn., is Architect.

Kansas City, Mo.—Bids are asked by the Board of Public Works until Sept. 10 for constructing Fire Dept. Station No. 11. A. Van Brunt & Bro., Navajo Bldg., Architects.

New York, N. Y.—Bids are asked by Bird S. Coler, Pres. Boro. of Brooklyn, until 11 a. m., Sept. 11, to prepare certain rooms on the first floor of the Municipal building, Boro. of Brooklyn, for occupancy by the Coroners and the Registrar of Water Rates, Boro. of Brooklyn.

New York, N. Y.—Bids are asked by Henry S. Thompson, Comr. Pub. Works, until 2 p. m., Sept. 5, for all labor and materials required for the alteration of the interior finish of the Governor's rooms in the City Hall, Boro. of Manhattan.

Roulette, N. D.—Bids are asked by Theo. A. Thorsen, Clk. School Board, until Sept. 9, for erecting a brick school in District No. 9.

Fort Sam Huston, Tex.—Bids are asked by L. J. Fleming, Const. Q. M., U. S. A., until Sept. 12, for constructing, plumbing and electric wiring of a dead house.

Pullman, Wash.—Bids are asked by State Board of Control, Olympia, until 2 p. m., Sept. 16, for the construction of a library and assembly hall building and heating for same, at the State College, Pullman.

Kingston, Ont.—Bids are asked by the Dept. Pub. Wks., Fred Gelinas, Secy., Ottawa, until Sept. 9, for alterations, additions and repairs to Block C, Tete du Pont Barracks, Kingston. H. P. Smith, Kingston, is Architect.

Roads and Streets

Items Arranged Alphabetically by States.

De Land, Fla.—Bids are asked by E. D McLeod, City Clerk, until Sept. 9, for constructing about 5,000 lin. ft. of 5-ft. sidewalks.

Champaign, Ill.—Bids are asked by George C. Fairclo, City Engineer, until 2 p. m., Sept. 6, for grading, draining, curbing and paving Daniel St. with asphalt.

Chicago, Ill.—Bids are asked by the Board of Local Improvements until Sept. 9 for paving various streets with asphalt on 6-inches of Portland cement concrete, swept with natural hydraulic cement. H. S. Dietrich is Pres. Bd. Local Impvs.

Mt. Vernon, Ind.—Bids are asked by the Board of County Commissioners of Posey County until Sept. 5 for grading and paving with macadam one road about 2 miles in length. Silas G. Howard is County Auditor.

Lebanon, Ind.—Bids are asked by the Board of County Commissioners until Sept. 24 for constructing a gravel road known as the Ezra Good Road. B. F. Simmons is County Auditor.

Mt. Vernon, Ind.—Bids are asked by the Board of County Commissioners of Posey County until Sept. 6 for constructing four gravel roads, comprising in all about 8 miles. Silas G. Howard is County Auditor.

Terre Haute, Ind.—Bids are asked by the County Commissioners until 11 a. m., Sept. 7, for grading and paving with cinders about 2½ miles of Road No. 5 in Nevins Township. J. W. Denehie, County Auditor.

Washington, Ind.—Bids are asked by the County Commissioners until 2 p. m., Sept. 7, for the construction of 2 gravel roads, known as Barber and Walker Roads. Thomas Nugent is County Auditor.

Frankfort, Ind.—Bids are asked by the County Commissioners of Clinton and Carrol Counties until 10 a. m., Sept. 20, for constructing gravel road No. 19, approximately 18,408 ft. in length. Chas. F. Cromwell is Auditor of Clinton County.

Bluffton, Ind.—Bids are asked by the Commissioners of Wells County until Sept. 6 for constructing 23 gravel roads in various townships. C. D. Brineman is County Auditor.

Indianapolis, Ind.—Bids are asked by the Board of Public Works until 10 a. m., Sept. 6, for grading and paving various streets.

LaPorte, Ind.—Bids are asked by City Council until 12 o'clock noon, Sept. 9, for paving Harrison St. with asphalt.

Cumberland, Md.—Bids will be received by the Road Directors of Allegheny County until 12 o'clock noon, Sept. 6, for grading and macadamizing about three-fourths of a mile of road. Clinton Uhl is Chmn. of Road Directors.

St. Paul, Minn.—Bids are asked by the Board of County Commissioners until Sept. 16 for improving a portion of Larpenteur Ave. Edward G. Krahmer is County Auditor.

St. Paul, Minn.—Bids are asked by the Board of County Commissioners until 10 a. m., Sept. 6, for the improvement of Larpentene Ave. from Lexington to Quincy Aves. Edward G. Krahmer is County Auditor.

Kansas City, Mo.—Bids are asked by the Board of Public Works until 11 a. m., Sept. 5, for repairing asphalt pavement on various streets. E. A. Harper is City Engr.

Kansas City, Mo.—Bids are asked by the Board of Public Works until 11 a. m., Sept. 5, for constructing asphalt oil macadam pavements on Mercer St. and on W. Prospect Pl. E. A. Harper is City Engr.

New York, N. Y.—Bids are asked by Moses Herrman, Pres. Dept. of Parks, until 3 p. m., Sept. 5, for repairing asphalt roadways of Glenmore Ave. and Eastern Parkway extension, and resurfacing walks in Prospect Park, Borough of Brooklyn; also paving, curbing, etc., semicircle at entrance to Central Park at 66th St. and Central Park West, Borough of Manhattan.

Monroe, N. Y.—Bids are asked by the Board of Village Trustees until 2 p. m., Sept. 5, for the construction of about 11,000 sq. ft. of cement sidewalks and about 1,400 lin. ft. of curbing. G. F. B. Carpenter, Village Clerk, and Fred Knight is Engineer.

Buffalo, N. Y.—Bids are asked by F. G. Ward, Commissioner Dept. of Public Works, until 11 a. m., Sept. 4, for paving portions of various streets.

Cincinnati, O.—Bids are asked by the Board of Public Service until 12 o'clock noon, Sept. 18, for grading, setting curves, paving with brick, Burnet Ave., from Donahue St. to Shillito St. J. M. Keefe is City Clerk.

Cincinnati, O.—Bids are asked by the Board of County Commissioners until Sept. 13 for the improvement of Reading Pike, between the city corporation line, Dayton Pike, Sycamore Township. Stanley Struble is Pres. Bd. of County Comrs.

Portsmouth, O.—Bids are asked by B. F. Royse, Pres. Board of Public Service, until 12 o'clock noon, Sept. 4, for grading, paving, etc., certain portions of Prospect St.

Silverton, O.—Bids are asked by A. A. Sprague, Village Clerk, until Sept. 12, for furnishing material and constructing cement sidewalks on various streets.

Marietta, O.—Bids are asked by the County Commissioners until 12 o'clock noon, Sept. 12, for grading, etc., certain portions of the Marietta Barlow Road. J. M. Williams is County Auditor.

Euclid, O.—Bids are asked by H. S. Dunlop, Village Clerk, until Sept. 16, for furnishing material and paving a portion of Euclid Road with macadam.

Cleveland Heights, O.—Bids are asked by Wm. G. Phare, Village Clerk, until Sept. 10, for grading, draining and paving with macadam Lee Road.

Bergholz, O.—Bids are asked by the Trustees of Springfield Township until Sept. 5 for grading and macadamizing about five miles of road in Springfield township. W. A. Taylor, Bergholz, is Clk. of Trustees. R. H. Lee, Carrollton, O., is Engr.

El Reno, Okla.—Bids are asked by L. G. Adams, City Clerk, until Sept. 5, for constructing 38,913 sq. yds. of vitrified brick pavement with asphalt filling, to be laid on a 5-in. base of concrete; also 4,922 lin. ft. of stone curbing.

Johnson City, Tenn.—Bids are asked by E. E. Ellsworth, City Recorder, until Sept. 5, for paving portions of various streets, in all, about 48,000 sq. yds., with vitrified brick, bitulithic, asphalt, Hassam or other good material; also 22,000 sq. ft. cement sidewalk, 4,600 lin. ft. concrete curb and 4,200 ft. of 8-in. vitrified sewer with necessary manholes, etc. L. N. Wilson, City Engr.

Dallas, Tex.—We are advised that bids will soon be asked, for laying approximately 50,000 sq. yds. of street paving. Wm. Doran is Comr. of Sts. and Pub. Property.

El Paso, Tex.—Bids are asked by the Commissioners' Court of El Paso County until 10 a. m., Sept. 9, for the construction of a macadam road along what is known as the county road. A. S. Eylar is County Judge.

Janesville, Wis.—Bids are asked by the Street Assessment Committee until Sept. 6 for grading, curbing and paving with brick, a portion of E. Milwaukee St.

West Allis, Wis.—Bids are asked by the Board of Public Works until 12 o'clock noon, Sept. 6 ,for macadamizing National Ave., from 68th Ave. to the Chicago & North Western tracks. F. Phillips, Jr., S. Bernard, W. E. Gerlinger, Bd. of Pub. Wks.

Sewers.

Items Arranged Alphabetically by States.

Chicago, Ill.—Bids are asked by John J. Hanberg, Commissioner Public Works, 221 City Hall, until 11 a. m., Sept. 11, for constructing 6½ ft. sewer in 35th St. extended and Illinois Central right-of-way.

Linton, Ind.—Bids are asked until 4 p. m., Sept. 16, by the Common Council, for constructing a system of sanitary sewers about 13 miles in length with a disposal plant. Estimated cost, $64,800. Frank Spelbring is City Clk.

Cedar Rapids, Iowa.—Bids are asked by the Board of Public Improvement, W. C. Byers, Chmn., until 10 a. m., Sept. 5, for constructing 6 and 8-inch sewers in various streets.

Togus, Me.—Bids are asked by the Treasurer, Eastern Branch, National Home for Disabled Volunteer Soldiers, until 12 o'clock noon, Sept. 19, for the improvement of the sewerage and drainage system. George W. Fuller, 170 Broadway, N. Y. City, is Engineer.

Canton, Miss.—Bids are asked by W. G. Kirkpatrick, Engineer, Jackson, Miss., until Sept. 19, for construction of approximately 7 miles of 18" to 6' pipe sewers, as advertised elsewhere in Engineering-Contracting.

Kansas City, Mo.—Bids are asked until 11 a. m., Sept. 5, for constructing sewers in various sewer districts. E. A. Harper is City Engr.

St. Paul, Minn.—Bids are asked until 2 p. m., Sept. 9, by the Board of Public Works, for constructing sewers in various streets. John S. Grode is Pres. Bd. of Pub. Wks.

South Orange, N. J.—Bids are asked by the Township Committee until 8 p. m., Sept. 17, for the construction of sanitary sewers in 2 sections of the Township, as advertised elsewhere in Engineering-Contracting.

Hoboken, N. J.—Bids are asked by the City Council until 8 p. m., Sept. 11, for cleaning and repairing sewer in Jackson St. James H. Londrigan, City Clerk.

New York, N. Y.—Bids are asked by the Dept. of Parks, Moses Herrman, Pres., until 3 p. m., Sept. 5, for the construction of a sewer in Van Cortlandt Park.

New York, N. Y.—Bids are asked by Bird S. Coler, Pres., Borough of Brooklyn, until 11 a. m., Sept. 11, for constructing sewers and sewer basins in various streets in Brooklyn.

Olean, N. Y.—Bids are asked by the Common Council until 7:30 p. m., Sept. 6, for laying a 10-inch vitrified pipe sewer in North Eleventh St. E. E. Allen, Supt. of Streets.

Bozeman, Mont.—Bids are asked until Sept. 5 for constructing pipe sewers. Estimated cost, $36,000. C. M. Thorps is City Engr.

Canton, O.—Bids are asked by the Board of Public Service, B. F. Faust, Clk., until 12 o'clock noon, Sept. 16, for constructing a sewer in North Cleveland Ave. Approximate quantities are as follows: 2,500 lin. ft. 8-in. vitrified pipe, 385 lin. ft. 6-in. vitrified pipe, 1,600 lin. ft. house connections, 11 manholes, one flush tank. W. E. Sarver is City Engr.

Philadelphia, Pa.—Bids are asked by the Dept. of Public Works, George R. Stearns, Director, until 12 o'clock noon, Sept. 11, for schedules B, C, D and E as follows. Schedule B, Main Sewers: Extension of Thomas Run system in Florence Ave., etc.; 1,572 ft. of 5-ft. to 5½-ft. brick sewer; appropriation, $30,000. Extension of Market St. sewer to 36th St.; 156 ft. of 5-ft. brick sewer; appropriation, $3,000. Extension of Wissahickon Lower Level intercepting sewer; 1,590 ft. of 3½-ft. brick sewer; appropriation, $29,500. Extension of Wissahickon High Level intercepting cut-off sewer; 1,267 ft. of 6-ft. brick sewer in tunnel; appropriation, $50,000. Extension of sewer in Bingham St. and Wyoming Ave.; 1,791 ft. of 3½-ft. to 4¾-ft. brick sewer; appropriation, $25,000. Extension of Jackson St. sewer from 33d to 29th Sts.; 1,846 ft. of 6½ to 7-ft. brick sewer; appropriation, $25,000. 12th St. sewer from Louden to Ruscomb Sts.; 1,073 ft. of 3½ to 4-ft. brick sewer; appropriation, $8,000. Ninth St., Butler and Tenth Sts. sewer, from Erie Ave. to Luzerne St.; 2,054 ft. of 4¾ to 5-ft. brick sewer; appropriation, $18,000. Schedule C, Branch Sewers: 32 contracts for brick sewers less than 3½ ft. in diameter; estimated cost, $100,000. Schedule D: inlets, laterals, etc.; estimated cost, $5,000. Schedule E: Reconstruction of Pine St. sewer; 300 ft. of 8-ft. brick and concrete sewer; appropriation, $25,000. George S. Webster is Ch. Engr.

Johnson City, Tenn.—Bids are asked until noon, Sept. 5, for constructing 4,200 ft. of 8-in. vitrified sewer with all necessary Y's., manholes, flush tanks, etc. L. N. Wilson, Jr., is City Engr.

Chattanooga, Tenn.—Bids are asked until Sept. 16 for constructing the Chestnut St. sewer from Ninth St. to the river.

Seattle, Wash.—Bids are asked by C. B. Bagley, Secy, Board Public Works, until 10 a. m., Sept. 7, for the construction of the Green Lake District of the North Trunk sewer.

Water Supply

Items Arranged Alphabetically by States.

Canon City, Colo.—Bids are asked by the City Clerk until Sept. 20 for constructing a reservoir at Cottonwood Creek, and pipe line to city water mains.

Washington, D. C.—Bids are asked until 2 p. m., Sept. 27, by the Commissioner of Indian Affairs, Washington, for improvements to the water system of Fort Lewis School, Colorado. C. F. Larrabee is Act. Comr.

Decorah, Ia.—Bids are asked by the Board of Supervisors until Sept. 10 (extension of date) for constructing a water system at the poor farm at Freeport, on either the automatic air pressure steel tank of 75-bbl. with 125-lb. pressure to the inch. 12-ft. steel wheel, steel tower 70 ft. high and pump to complete the work, or 500-bbl. tank overhead system, 60 ft. high. I. Linnevols, County Auditor.

Stambaugh, Mich.—Bids are asked by the Village Council until 8 p. m.,' Sept. 9. for improving the water works system. Erik Erikson is Village Clerk.

Cazenovia, N. Y.—Bids are asked by the Board of Water Commissioners, W. L. Doremus, Clerk, until 3 p. m., Sept. 4, for furnishing and laying water mains, etc.

Leesburg, O.—Bids are asked by W. H. Mason, Clerk Board of Public Affairs, until 12 o'clock noon, Sept. 5. for the construction of a portion of the water works.

Excavation—Earth and Rock

Items Arranged Alphabeticalty by States.

Plaquemine, La.—Earth Filling—Bids are asked by J. T. McIndoe, Corps Engrs., U. S. A. Custom House, New Orleans, for placing about 20,000 cu. yds. of earth filling behind lock walls at Plaquemine.

Plaquemine, La.—Earth Filling—Bids are asked by Capt. J. F. McIndoe, Corps Engrs., U. S. A. Custom House, New Orleans, until Sept. 16, for placing about 20,000 cu. yds. of earth filling behind lock walls at Plaquemine.

Boston, Mass.—Dike Work—Bids are asked by the Board of Harbors and Land Commissioners until 2 p. m., Sept. 6, for constructing a dike at Herring River, Wellfleet. The work consists of the building of an earthen embankment 935 ft. long, containing about 14,000 cu. yds. of material. Whitman & Howard, Construction Engineers, 220 Devonshire St., Boston.

Clayton, Mich.—Drain—Bids are asked by Hope Welch, County Drain Commissioner, until 10 a. m., Sept. 17, for the construction of a drain known as "Clayton Tile Drain."

Detroit, Mich.—Dredging—Bids are asked by Chas. E. L. B. Davis, Col. Engrs., U. S. Engrs. Office, Jones Bldg., Detroit, until 3 p. m., Oct. 8, for dredging Sec. 1, Plan B. Detroit River.

Detroit, Mich.—Excavating—Bids are asked by Chas. E. L. B. Davis, Col. Engrs., U. S. Engrs. Office, Jones Bldg., Detroit, until 3 p. m., Oct. 7, for rock and earth excavation Sec. 2, Plan B. Detroit River.

Estherville, Ia.—Ditch Work—Bids will be received Sept. 11 and 12 by Roy J. Ridley, County Auditor, for constructing ditches Nos. 23, 30, 31 and 32.

New York, N. Y.—Dredging and Rock Removal—Bids are asked by Col. John G. D. Knight, Corps. Engr., U. S. Engineer Office, Army Building, New York, until 12 o'clock noon, Sept. 30, for rock removal and dredging in Sangerities Harbor, as advertised in Engineering-Contracting.

Newport, R. I.—Drill Ground—Bids are asked until 10 a. m., Sept. 16, by Constructing Quartermaster, 209 Thomas St., Newport, for constructing drill ground at Fort Greble, R. I., including grading, construction of drains, sodding, etc.

Seattle, Wash.—Dredging—Bids are asked by Major H. M. Chittenden, Corps Engrs., U. S. A., until 12 o'clock noon, Sept. 18, for dredging Pend d'Oreille River, Wash.

Peterboro, Ont.—Canal—Bids are asked by Alex. J. Grant, Supt. Engr., Trent Canal, Peterboro, until Oct. 10, for the work connected with the construction of Section 1, Ontario-Rice Lake Division of the canal. L. K. Jones, Secy. Dept. of Rys. and Canals, Ottawa.

Honolulu, T. H.—Dredging—Bids are asked by C. W. Otwell, Capt. Engrs., U. S. Engineer Office, Honolulu, until 12 o'clock noon, Sept. 9. for dredging in Honolulu Harbor.

Miscellaneous

Items Arranged Alphabetically by States.

Fort Dupont, Delaware City, Del.—Freight Wharf.—Bids are asked by Capt. J. L. Knowlton, Constructing Quartermaster, until 10 a. m., Sept. 26, for reconstruction of freight wharf at Fort Dupont, Del.

Boston, Mass.—Wrecking Work—Bids are asked by Maj. Edward Burr, Corps of Engrs., U. S. A., until Sept. 19. for the removal of a wreck of a canal boat in the Great Chasy River, N. Y.

University Place, Neb.—Electric Light Plant—We are advised that bids will be received for engines, generators and switchboards for the proposed municipal electric plant. It will have a capacity of 3,500 16-c. p. incandescent lights. Baker & Early, Lincoln, Neb., are Engrs. Estimated cost, $18,000.

Portsmouth, N. H.—Power House—Bids are asked until 11 a. m., Sept. 21. by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing an extension of the power house, at the Portsmouth navy yard.

Buffalo, N. Y.—Pier Work—Bids are asked by the Department of Public Works until Sept. 5 for constructing a pile pier on the south line of Jersey St. F. G. Ward is Comr. of Pub. Wks.

Boston, Mass.—Tunnel Work– Bids are asked by the Boston Transit Commission, B. Leighton Beal, Secy., until Sept. 5, for constructing entrances and exits at Summer St., for the Washington St. tunnel.

Napanoch, N. Y.—Power House—Bids are asked by Henry Melville, Pres. Board Managers, Elmira Reformatory, Elmira, until noon, Sept. 14, for furnishing and erecting all structural steel and iron work for power house and stack, and conduits, at Eastern New York Reformatory, Napanoch, N. Y. G. L. Heins, State Archt., Albany.

Winnipeg, Man.—Hydro-Electric Station—Bids are asked by the Chmn. Board of Control, Winnipeg, until 12 o'clock noon, Oct. 1, for the construction of general work and supply of equipment for the hydro-electric station at Point du Bois. M. Peterson is Secy.

Materials, Machines, Supplies, Tools, Etc

Items Arranged Alphabetically by States.

Los Angeles, Cal.—Water Pipe and Pumping Machinery—Bids are asked by Wm. Mulholland, Supt. Bd. of Water Comrs., until 3:30 p. m., Sept. 30, for furnishing f. o. b. cars, Los Angeles, about 6,000 tons standard hub and spigot cast-iron water pipe. At same time for 2 water tube boilers, 300-h. p. each, and one 7,000,000-gallon cross-compound pumping engine. F. J. Fisher, Ch. Mech. Engr.

Washington, D. C.—Machinery—Bids are asked by the General Purchasing Officer, Isthmian Canal Commission, until 10:30 a. m., Sept. 25, for furnishing machinery, as advertised elsewhere in Engineering-Contracting.

Rock Island, Ill.—Lumber—Bids are asked by Maj. C. S. Richie, Corps of Engrs., U. S. A., until Sept. 10. for furnishing and delivering f. o. b. cars, for lumber.

New Orleans, La.—Lumber and Piling—Bids are asked by the Board of Commissioners of the Port of New Orleans until Sept. 17 for furnishing and delivering such lumber and piling as may be ordered for repairs, etc., for a period of 1 year from date of contract.

Jefferson Barracks, Mo.—Boilers—Bids are asked by O. W. Bell, Q. M., U. S. A., until Sept. 12, for furnishing and installing boilers in officers' quarters.

Buffalo, N. Y.—Pumps—Bids are asked by the Department of Public Works, F. G. Ward, Comr., until 11 a. m., Sept. 10, for furnishing two vertical triplex boiler feed pumps and feed water heater for the pumping station Bureau of Water.

New York, N. Y.—Lumber, Pipe-Fitting, etc.—Bids are asked by the Department of Health until 9 a. m., Sept. 9, for furnishing and delivering as needed, lumber, timber, pipe, fittings, stop-cocks, valves, paints, oils, varnishes and miscellaneous plumbers', steamfitters', and painters' supplies to the Hospitals of the Dept. of Health in the various boroughs of the city of New York.

West Point, N. Y.—Gas and Electric Fixtures.—Bids are asked by J. M. Carson, Jr., Major and Quartermaster, U. S. M. A., until 12 o'clock noon, Sept. 30, for furnishing and installing combination gas and electric lighting in old and new Cadet barracks.

Cincinnati, O.—Dredge—Bids are asked by Maj. J. G. Warren, Corps Engineers, U. S. Engineer Office, Custom House, Cincinnati, until 2 p. m., Sept. 30, for the construction of a dredge, as advertised in Engineering-Contracting.

Lawrenceburg, Tenn.—Machinery—Bids are asked by Walter G. Kirkpatrick, Engineer, Jackson, Miss., until Sept. 13, for labor and materials necessary for constructing and installing machinery for a Hydro-electric Water Works and Lighting Plant, as advertised elsewhere in Engineering-Contracting.

Honolulu, T. H.—Materials—Bids are asked by C. W. Otwell, Capt. Engrs., U. S. Engineer Office, until 12 o'clock noon, Oct.

15, for furnishing and delivering 14,000 lbs. Portland cement, 16,500 tons broken stone, and 7,000 tons sand, as advertised in Engineering-Contracting.

CONTRACTS LET.

Items Arranged Alphabetically by States.

Livingston, Ala.—Building—C. H. Dobbs, Meridian, Miss., has been awarded the contract at $20,000 for the construction of a school house at this city.

Wetumpka, Ala.—Bridge—The Chattanooga Bridge Co., has been awarded the contract for the erection of a bridge across the Coosa river.

Arkadelphia, Ark. — Sewer — Robinson Bros., Pine Bluff, have been awarded the contract at $28,362 for the construction of 8½ miles of sewer. The mains will be of 8, 10 and 12-inch piping.

Camden, Ark.—Sewer—B. C. Pouncey, Helena, has been awarded the contract at $6,260 for the construction of 2 miles of sewer in this city.

Colton, Cal.—Water Mains—W. W. Wilcox, Colton, has been awarded the contract for placing water mains in the new town of Crestmore, south of Bloomington, near Colton.

Lincoln, Cal.—Sewer—Downing & Sons, Palo Alto, have been awarded the contract at $17,342 for the construction of the Lincoln sewer system.

Lincoln, Cal.—Sewer.—Downing & Sons, Palo Alto, Cal., have been awarded contract at $17,342, for constructing the Lincoln sewer system.

Morysville, Cal.—Bridges—C. W. Swain has been awarded the contract for the construction of 2 bridges across Dry Creek, one at Comptonville at $2,868, and the other at Jasper Lane Crossing at $2,930.

Oroville, Cal.—Bridge—The Pacific Construction Co. have been awarded the contract at $6,500 for the construction of this city's portion of a bridge across the Feather River.

Colorado City, Colo.—Building—Honeyman & Auld, Colorado Springs, have been awarded the contract for the erection of the First Christian Church.

Augusta, Ga.—Railroad Construction—Schofield & Sons, Philadelphia, Pa., have been awarded the contract for the construction of the Georgia and Florida R. R., which will extend to the Guf of Mexico from this place.

Bloomington, Ill.—Bridge—The Decatur Bridge Co. has been awarded the contract for the erection of a steel bridge 45 ft. in length, across Ten Mile Creek.

Chicago, Ill.—Street Work and Sewer—The Barber Asphalt Pavement Co. has been awarded the contract for grading, paving, etc., on West 14th St. from South Halsted to South Wood St., and Nash Bros. have been awarded the contract for a tile pipe sewer in Milwaukee Ave. from West Montrose Ave. to West Bertran Ave.

Dollas City, Ill.—Water Works—H. J. Cole, South Bend, Ind., has been awarded the contract at $9,499 for the construction of a water works system at this place.

McLeansboro, Ill. — Building — Edward Snell, Grayville, has been awarded the contract at $15,000 for the erection of the new Methodist Episcopal Church in this city.

Paris, Ill.—Building—Mr. Engledrum has been awarded the contract for a new theater building to be erected on North Main St.

Pekin, Ill.—Sewer System—E. R. Harding, Racine, Wis., has been awarded the contract at $113,977 for the construction of a sewer system in this city.

Shawneetown, Ill.—Electric Light Plants. A. L. Swanson, Evansville, Ind., has been awarded the contract for the construction of a complete electric lighting plant.

Pekin, Ill.—Sewer.—E. R. Harding, Racine, Wis., has been awarded contract at $113,979 for constructing the Fourth district sewer.

Covington, Ind.—Road Work—T. J. Allen has been awarded the contract at $10,600 for the construction and repair of grades on the Hiram Allen, the Kraut and the Howard Roads, and J. B. Thomas has been awarded the contract at $4,675 for the Jacobs V. Philpott Road.

Peru, Ind.—Court House—P. H. McCormack has been awarded the contract for the erection of a new Court House.

Marion, Ind. — Street Work — Dillard Artis has been awarded the contract at 54 cents a ft. for the construction of side walks on Seventh St.

Vincennes, Ind.—Street Work—Foulkes, Forbes & Co., Terre Haute, have been awarded the contract for the improvement of Reel Ave. by grading and graveling the roadbed and by putting down concrete sidewalks and stone curbing. The contract price is embankment, 30 cents; excavation, 20 cents; gravel, 85 cents; curbing, 45 cents, and sidewalks, 10¾ cents.

Evansville, Ind.—Sewer.—T. W. Murray has been awarded contract for constructing a sewer in Block 96. Bid as follows: 38 cents per foot for furnishing and laying pipe and $1.50 for Ys.

Portland, Ind.—Sewer.—N. R. Griffith, Portland, has been awarded the contract at $8,463 for the construction of a 36-in. sewer in Pleasant St.

Goshen, Ind.—Bridges.—The Elkhart Construction Co. has been awarded the contract for the construction of 4 bridges.

South Bend, Ind.—Paving.—G. C. Sagenaw, South Bend, has been awarded the contract for paving 6 blocks on Broadway with brick.

Des Moines, Ia.—Sewers—The George M. King Construction Co. has been awarded contract at $1.37 per lin. ft., for constructing the Center Drive sewer.

Des Moines, Ia.—Bridge—Bids were received Aug. 20 for constructing the Locust St. Bridge. Bids as follows: Barney Marsh Bridge Co., Des Moines, Ia., $124,800; N. M. Stark, Des Moines, $142,600, and the Cook Construction Co., Chicago, $128,967.75.

Lehigh, Ia.—Factory Building—Johnson & Nelson, Red Lake Falls, Minn., have been awarded the contract at $150,000 for constructing a sewer pipe and tile factory at this place.

Burlington, Kan.—Bridge—The Topeka Bridge Co., Topeka, Kan., has been awarded contract at $3,865 for constructing a reenforced concrete bridge across Rock Creek. The bridge is to be 45 ft. in length and 100 ft. wide.

Cottonwood, Kans.—Bridges—The Blodgett Bridge Co., Kansas City, has been awarded the contract for the construction of 2 bridges and 1 approach. The bridges are to be across Diamond Creek at the Ramsey crossing and across Mercer Creek south of Matfield, and the approach is the north approach of the Rock Creek bridge. Contract price $3,537.

Wichita, Kans.—Building—George W. Doge, Wichita, has been awarded the contract at $4,000 for the erection of an addition to the city school building at Norwich.

Kansas City, Kans.—Bridges—The Midland Bridge Co. have been awarded the contract to build an iron bridge over Island Creek near N. Polfers, Prairie Township. Contract prices were $175 for straightening the bridge, concrete $9.50 a cu. yd.; masonry $5.25. The same company was also awarded the contract for a bridge over Island Creek near school house No. 25 in Prairie Township. Contract prices were $898 for straightening bridge, $5.50 per yd. for masonry, and $9.75 per cu. yd. for concrete.

Paducah, Ky.—Bridge—The Nashville Bridge Co. has been awarded the contract at $6,790 for the construction of a bridge over Massac Creek on the Blandville Road.

Havre de Grace, Md.—Bridge.—Eyre-Shoemaker, Philadelphia, Pa., has been awarded contract for constructing a steel bridge over the Susquehanna River for the Baltimore & Ohio R. R. The bridge is to be 7,000 ft. in length and cost about $2,000,000.

Pittsfield, Mass.—Reservoir Dam—The Armbursen Hydraulic Construction Co., 176 Federal St., Boston, has been awarded the contract for constructing reservoir dam at Ashley Brook to create an additional water supply. Dimensions are 32 ft. in height by 465 ft. long.

Merrill, Mich.—Sewers—Ed. Eislee, Saginaw, has been awarded the contract for the new Alice and Midland St. sewers.

Coleraine, Minn.—Water Supply—A. G. Osman, Duluth, has been awarded the contract for the water works and sewer system.

Winnebago, Minn.—Sewers—The J. W. Turner Co., Des Moines, Ia., have been awarded the contract at $15,000 for the construction of sewer at this place.

St. Joseph, Mo.—Building.—Isele Bros., Memphis, Tenn., have been awarded the contract at $425,000 for the construction of a fireproof steel construction hotel building.

Winside, Neb. — Water Works — The Sioux City Foundry and Mfg. Co. have been awarded the contract at $10,000 for putting in a waterworks system, including a pumping station, steel tank and tower.

New York, N. Y.—Power Plants.—The American & British Manfg. Co., Providence, R. I., have been awarded the contract for the construction and equipment of 2 large light and power plants. This contract involves $10,000,000.

Washington, Pa.—Paving.—The Fort Henry Construction Co., Wheeling, W. Va., has been awarded the contract for the improvement of the Point Lookout road at $7,886, and the Dry Run road at $30,000. The work is to consist of paving with macadam. The W. E. Howley Construction Co., Pittsburg, has been awarded the contract at $50,000 for the extension and improvement of the West Middletown road and the Finleyville-Alleghany county line road.

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10-1t Jackson, Miss.

SEWERS.

Canton, Miss.

Bids will be received till Sept. 19, 1907, for materials and labor for system of house sewers complete, approximately seven miles of 18-inch to 6-inch pipe sewers. Deposit 3% of bid. For specifications and further information address Walter G. Kirkpatrick, Engineer, Jackson, Miss.

10-1t O. S. MILLER, Mayor.

LAKE VIEW PUMPING STATION DEPARTMENT OF PUBLIC WORKS.

CHICAGO, August 30, 1907.

Sealed proposals will be received by the city of Chicago until 11 a. m. Friday, September 13, 1907, at room 224, city hall, for the furnishing of all materials, tools, labor, machinery, and appliances of whatsoever kind or description necessary to construct the superstructure of an engine house, together with foundation and superstructure for a connecting building, at the Lake View pumping station, located at the northeast corner of Montrose boulevard and Clarendon avenue, in the city of Chicago, according to plans and specifications on file in the office of the Department of Public Works of said city, room 325, city hall.

Proposals must be made out upon blanks furnished at said office, and be addressed to said department, indorsed "Proposals for Lake View Engine House," and be accompanied with five thousand dollars in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago and made payable to the order of the commissioner of public works

The commissioner of public works reserves the right to reject any or all bids.

A deposit of $5.00 will be required to insure the safe return of plans and specifications.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the commissioner of public works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names as well as the name of the firm with their address.

JOHN J. HANBERG,
Commissioner of Public Works.
By PAUL REDIESKE,
10-2t Deputy Commissioner.

DREDGING—U. S. Engineer Office, Jones Building, Detroit, Mich., Aug. 26, 1907.—Sealed proposals for dredging section 1, plan B, Detroit River, will be received here until 3 p. m., Oct. 8, 1907, and then publicly opened. Information furnished on application. CHAS. E. L. B. DAVIS, col., engrs.

SEWERAGE SYSTEM.

Township of South Orange, N. J.

Sealed proposals will be received by the Township Committee of the Township of South Orange, at their rooms in Maplewood, N. J., until 8 o'clock p. m., Tuesday, September 17, 1907, for the construction of sanitary sewers in two sections of the Township and requiring quantities approximately as follows:

Maplewood District—
- 3,460 feet of 10-inch vitrified pipe sewer.
- 15,090 feet of 8-inch vitrified pipe sewer.
- 63 manholes.
- 12 flush tanks.

South Orange Heights District—
- 250 feet of 10-inch vitrified pipe sewer.
- 16,648 feet of 8-inch vitrified pipe sewer.
- 47 manholes.
- 13 flush tanks.

Proposals for each district must be made separately and each accompanied by a certified check for $2,000, made payable to the "Township of South Orange." Plans and specifications can be seen at the Public Building, Maplewood, N. J., and at the office of Alexander Potter, Consulting Engineer, 143 Liberty St., New York City.

The right is reserved to reject any or all bids.

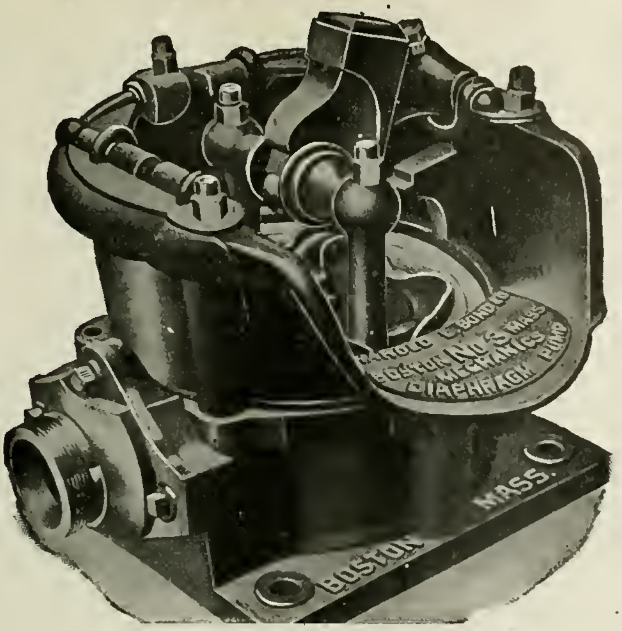
By order of the Township Committee.

EDWARD R. ARCULARIUS,
Township Clerk.
ALEXANDER POTTER,
Consulting Engineer, 10-2t

CEMENT, STONE AND SAND—U. S. Engineer Office, Honolulu, T. H., Aug. 15, 1907.—Sealed proposals for furnishing and delivering 14,000 barrels Portland cement, 16,500 tons broken stone, and 7,000 tons sand, will be received here until 12 m., Oct. 15, 1907, and then publicly opened. Information furnished on application. C. W. OTWELL, capt., engrs.

ROCK EXCAVATION AND DREDGING—U. S. Engineer Office, Jones Building, Detroit, Mich., Aug. 26, 1907.—Sealed proposals for rock and earth excavation, section 2, plan B, Detroit River, will be received here until 3 p. m., Oct. 7, 1907, and then publicly opened. Information furnished on application. CHAS. E. L. B. DAVIS, col., engrs.

DREDGING AND ROCK REMOVAL—U. S. Engineer Office, Room F-7, Army Building, New York, N. Y., Aug. 30, 1907.—Sealed proposals for rock removal and dredging in Saugerties Harbor, N. Y., will be received at this office until 12 m., Sept. 30, 1907, and then publicly opened. Information furnished on application. JOHN G. D. KNIGHT, col., engrs.



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WATER-WORKS SUPPLIES.

Office of the Board of Water Commissioners of the City of Los Angeles.

August 19, 1907.

Sealed proposals will be received by the Board of Water Comissioners of the City of Los Angeles, at the office of said Board, 440 S. Hill Street, up till 3:30 P. M. of September 30, 1907, for furnishing and delivering f. o. b. cars at Los Angeles, California, approximately 6,000 tons of Standard Hub and Spigot Cast Iron Water pipe, as follows:

920 pcs.	24-inch.
955 "	20 "
670 "	20 "
490 "	20 "
2,500 "	12 "
500 "	10 "
1,000 "	8 "
2,000 "	6 "
2,500 "	4 "

Specifications can be obtained, upon application, from the Secretary, at 440 S. Hill Street.

A certified check for five per cent. of the amount of the bid, made payable to Jno. J. Fay, Jr., President of the Board, is to accompany each proposal, to be held as a guarantee that a contract with bond approved by the said Board will be entered into by the party whose bid is accepted, in accordance with the terms of the said bid.

The Board reserves the right to reject any or all bids, in whole or in part.

WM. MULHOLLAND,
Superintendent.

10-2t

BOILERS AND PUMPING MACHINERY

Office of the Water Department of the City of Los Angeles.

August 19, 1907.

Sealed proposals will be received by the Board of Water Commissioners of the City of Los Angeles, at its office, No. 440 S. Hill Street, up till 3:30 P. M. of September 30, 1907, for two water-tube boilers of 300 horse power each, and one seven-million gallon cross-compound pumping engine, in accordance with specifications on file with F. J. Fischer, Chief Mechanical Engineer, at the above address.

Bids will be received separately for boilers and machinery.

A certified check for 5 per cent. of the amount of the bid, made payable to Jno. J. Fay, Jr., President of the Board, is to accompany each proposal, to be held as a guarantee that a contract with bond approved by the said Board, will be entered into by the party whose bid is accepted, in accordance with the terms of the said bid.

The Board reserves the right to reject any or all bids.

WM. MULHOLLAND,
Superintendent.

10-2t

DRAINAGE WORK.

BIDS WANTED.

Drainage district No. 2, Town of Rich, Cook County, Illinois.

Notice to Contractors.

Notice is hereby given that the drainage commissioners of District No. 2 of the Town of Rich, Cook County, Illinois, will receive sealed bids at the office of Albert Reese, Town Clerk, Matteson, Illinois, until noon of the 12th day of September, 1907, for the construction of a system of drains in said district.

Each bid must be accompanied by a certified check equal to 5 per cent of the aggregate of the proposal. Checks will be returned to unsuccessful bidders upon the letting of the contract, and to the successful bidder upon the execution of the contract and furnishing a bond in the sum of $5,000, with security, to be approved by the commissioners, condition for the faithful performance of the contract.

Said commissioners will open said bids at 1 o'clock p. m. of said day at said office. Privilege is reserved to reject and any all bids.

The work to be let consists of about 6½ miles of open dredge ditch, varying from 6 to 14 feet bottom width, with side slopes of 1 to 1. Also 700 feet of 12 inch, 4,500 feet of 15 inch, and 1,600 feet of 22 inch tile, ditch having an average depth of about 5½ feet. Total excavations, about 115,000 cubic yards. Profiles, plans, and specifications for said work can be examined at the office above mentioned. Contractors are further expected to acquaint themselves with the conditions on the premises before bidding.

For information, apply to H. S. Blanchard, attorney, Chicago Heights, Illinois, or F. L. Knight & Sons, engineers, Crown Point, Indiana.

D. SIEBRANDT,
J. H. SCHUMACHER,
FRED MARQUARDT,
Commissioners.

STORM WATER SEWER.

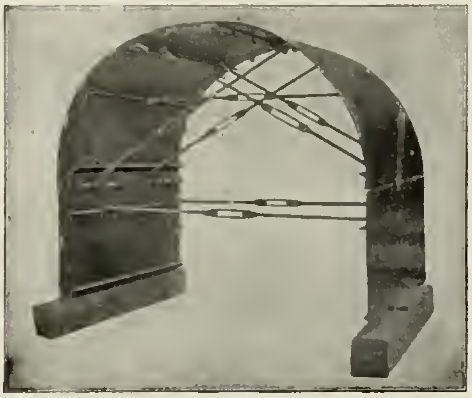
Monessen, Pa., August 15, 1907

Sealed proposals will be received at the office of the Borough Engineer until 4 o'clock p. m., Thursday, September 5th, for the construction of a storm water sewer and appurtenances as follows: 700 lin. feet of 4 foot 6 inch by 6 foot 9 inch oval shaped 3-ring brick, as per plans and specifications on file in the office of the Borough Engineer.

J. F. IRWIN,
Borough Engineer.
W. A. MILLER,
Chairman St. and Roads Com.

The Blaw Collapsible Center

FOR SEWERS AND CULVERTS



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Cost of Concrete Construction of All Kinds.
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WANTED—ROOFING—Quote us prices on 15,000 square feet of corrugated sheet iron for covering buildings. Bell Electric Motor Co., Garwood, N. J.

WANTED—Second-hand blue print frame, complete, about 24x30. State make, condition and price. Address "T. L. A.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

CATALOGS—The technology department of Carnegie Library, Pittsburg, is making an extensive collection of trade catalogs. These will be carefully indexed under both firm name and subject, and will be accessible to the public. Mention this paper and address H. W. Carver, care of Technology Department.

WANTED—Required by leading German engineering works of world, wide reputation, an experienced engineer as representative with first-class connections in American railway financial circles, occupied in floating new companies and carrying out new lines; must be well up in all technical details and capable of managing also the commercial part. Send fully detailed proposals with references to F. F., 5586, care Rudolf Mosse, Berlin, S. W.

WANTED—Machinery for making garment hooks and eyes and for sewing same on cards. Dr. H. B. Cressman, 115 South 17th St., Philadelphia, Pa.

WANTED—Name and address of New York party who on Aug. 31 sent us typewritten postal card requesting catalogs on various subjects but omitted to sign his name or give any clue as to identity or address. Engineering-Contracting, 355 Dearborn St., Chicago.

WANTED—A second-hand lathe to handle shafting 5 ft. long and have a 24-in. swing; also a bolt-making machine. Address S. B. Doyle, Railroad Contractor, Emerald, Neb.

WANTED—Position—Civil engineer, with 8 years' experience desires position with firm of contractors. Address "X. Y. G.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

WANTED—IMMEDIATELY — Hoisting engine of 50 H. P. and an orange peel or clamshell bucket. Must purchase at once for immediate shipment. H. A. Drumm, 1429 Monadnock Block, Chicago.

WANTED — Drawings, Maps, Lettering, Plats, Tracings to make, by experienced draftsman. 421 North Blackford St., Indianapolis, Ind. 8-6t

THE UNITED STATES CIVIL SERVICE COMMISSION announces an examination in 210 cities on September 11-12, 1907, to secure eligibles from which to make certification to fill three vacancies in the position of miscellaneous computer, Naval Observatory, Washington, D. C., and similar vacancies as they may occur in that observatory. The Department states that miscellaneous computers are paid by the hour and earn from $800 to $1,000 per annum. Promotions are made from this grade without further examination to the grade of computer, at $1,200 per annum, as vacancies occur. As an insufficient number of eligibles to meet the needs of the service were secured from previous examinations held for this position, qualified persons are urged to enter this examination.

WANTED — POSITION — Mechanical engineer 26, five years' experience shop management and construction; best references; $125 least salary. "W. E. C.," 6405 Parnell Ave., Chicago. 10-4t

WANTED—Locomotive crane to handle 1½ to 2-yard bucket in excavating sand. Address "K. S.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

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See page 20

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DREDGE—U. S. Engineering Office, 415 Custom House, Cincinnati, Ohio, Aug. 31, 1907.—Sealed proposals for constructing dredge will be received here until 2 p. m., standard time, Sept. 30, 1907, and then publicly opened. Information furnished on application here or to Mr. W. H. McAlpine, assistant engineer, Frankfort, Ky. J. G. WARREN, maj., engrs.

PROPOSALS FOR STEAM SHOVELS, Steam Churn Drills; Air Compressor Plant, including Air Compressors, Air Receivers, Boilers, Steel Stack, Smoke Box, Pumps, Condenser, Feed Water Heater, Oil Separator, Header, Valves and Fittings; Tandem Compound Engine and 100-kilowatt Generator, Induction Motors, Transformers, Rock Drills and Equipment, Steel Rails, Splice Bars, Tie Plates, Track Bolts and Spikes, Frogs, Switches, Switch Stands, Steel, Iron, Rivets, Wrought-Iron Pipe, Drill Bits, Machinist Hand Taps Clamp Screws, Snatch Blocks, Molder's Bellows, Melting Ladles, Safes, Steam Whistles, Steam Traps, Wheelbarrows, Water Coolers, Rubber Sleeves for Suction Dredge, Canvas Belting, Manila Rope, Boiler Compound, Red Lead, Borax, Cross-ties, Piles, Lumber, etc Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 10:30 a. m., September 25, 1907, at which time they will be opened in public, for furnishing the above-mentioned articles. Blanks and general information relating to this Circular (No. 388) may be obtained from this office or the offices of the Assistant Purchasing Agents, 24 State St., New York City; Custom House, New Orleans, La.; also from Chief Quartermaster, Chicago; Depot Quartermaster, St. Louis; Depot Quartermaster, Jeffersonville, Ind., and Chief Quartermaster, Atlanta, Ga., and at U. S. Engineer's Office in the following cities: Baltimore, Md.; Philadelphia, Pa.; Pittsburg, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; St. Paul, Minn.; Detroit, Mich., and Milwaukee, Wis.—H. F. Hodges, General Purchasing Officer.

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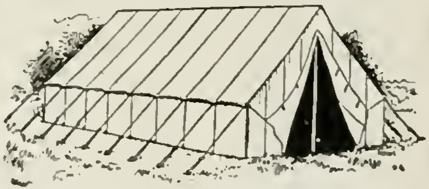

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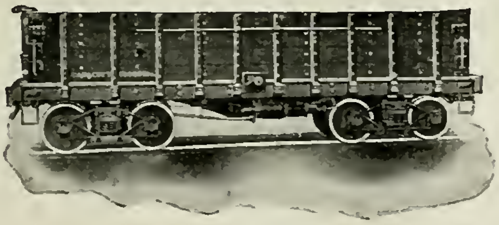

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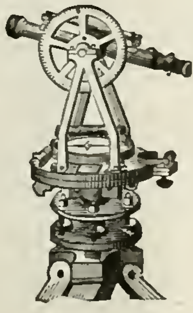

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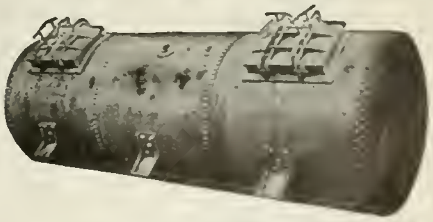

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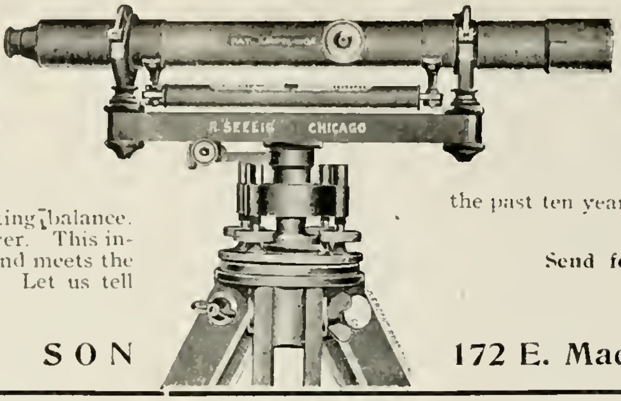

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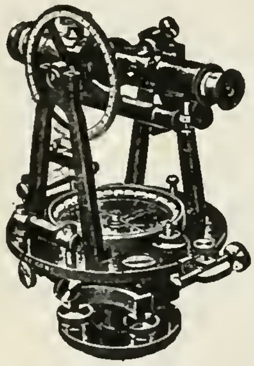

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Jamaica Plain Station

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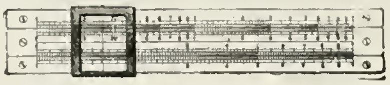

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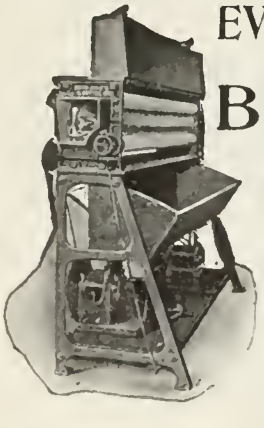

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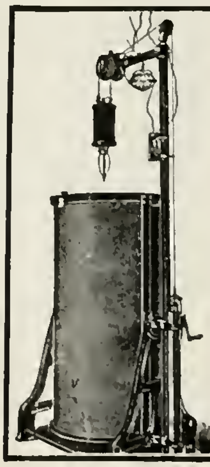

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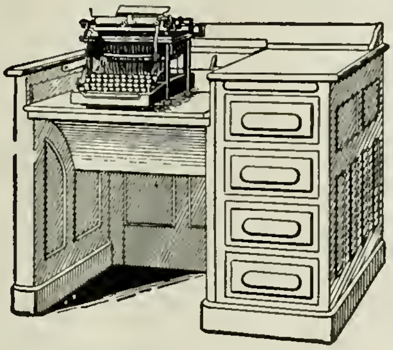

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Blowers. See 180.
36 Blue print machines.
38 Boilers.
39 Boiler covering.
40 Brakes, air.
42 Brick, building.
44 Brick, paving.
45 Brick machines.
46 Bridges.
48 Buckets, clam shell.
50 Buckets, dumping.
52 Buckets, orange peel.

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64 Cars, dump.
66 Cars, flat.
68 Cars, hand.
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70 Carts. See also 520.
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Draftmen's instrs. See 154.
124 Dredges.
126 Drill sharpeners.
Drills, air. See 136.
128 Drills, core.
130 Drills, diamond.
132 Drills, pneumatic, plug.
134 Drills, ratchet.
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144 Dynamos.

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169 Expanders, tube.
170 Exploders.
172 Explosives.

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184 Fence and railing.
186 Filters, water.
188 Flanges, steel.
190 Flue lining.
192 Flush tanks.
194 Forges, blacksmith.
196 Frogs.
198 Fuel economizers.
Fuse. See 170.

210 Garbage furnaces.
212 Gates and valves.
214 Gears and pinions.
216 Governors, engine.
218 Governors, water wheel.
220 Graders, elevating.
222 Gaskets.
224 Grubbers.

228 Hammers, pneumatic.
230 Hangers, joist.
232 Harness.
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236 Hoists, chain, differential.
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248 Hose.
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260 Injectors.

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264 Iron, corrugated.
266 Iron, sheet.

270 Jacks, hydraulic.
272 Jacks, screw.
274 Jacks, track.
Jacks, trench. See 502.

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284 Lathe, metal.
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288 Lime.
290 Locomotives, dinkey.
292 Locomotives, electric.
294 Locomotives, gasoline.
296 Locomotives, geared.
298 Locomotives, steam.
300 Lubricants.
302 Lumber, creosoted.

310 Machine tools.
312 Manganese steel.
314 Manhole covers.
315 Metaline.
316 Meters, water.
318 Mineral wool.
320 Mixers, concrete.
322 Motors, compressed air.
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326 Motors, water.

330 Nickel steel.
332 Nuts and nut locks.

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340 Packing.
342 Paints.
344 Paving blocks, stone.
Paving bricks. See 44.
348 Picks.
350 Pile drivers.
352 Pile driver jets.
354 Piles, concrete.
356 Piles, interlocking, steel.
358 Piles, creosoted.
360 Pipe covering.
362 Pipe, cast iron.
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374 Pipe cutting machine.
375 Pipe tapping machines.
376 Plows.
Plows, unloading. See 12.
Pneumatic tools. See 8, 132, 416.
382 Powder, black.
383 Prism glass.
384 Pulleys.
386 Pumps, diaphragm.
388 Pumps, electric.
392 Pumps, sand.
394 Pumps, steam.
396 Pumps, trench.
398 Punches, hydraulic.

400 Quarry bars.

410 Rails, new.
412 Rails, second hand.
414 Rammers, pneumatic.
416 Riveters, pneumatic.
418 Road machinery.
Rock crushers. See 114.
422 Rollers, horse.
424 Rollers, steam.
425 Roofers' supplies.
426 Roofing.
427 Rope drive.
428 Rope, manila.
430 Rope, wire.

Sand pump. See 392.
Scale box. See 462.
442 Scarifiers for macadam.
444 Scrapers, drag.
446 Scrapers, road.
Scrapers, wheel. See 528.
448 Screens, rotary.
450 Second hand outfits.
Sewer braces. See 502.
454 Sewer cleaners.
456 Sewer pipe.
457 Shafting.
458 Sheaves.
460 Shovels, hand.
462 Skips.
464 Slate.
466 Sprinkling carts.
468 Standpipes.
470 Steam shovels.
472 Steel, structural.
474 Steel for reinf. concrete.
476 Stone, broken.
478 Stone dressing mach's.
480 Stump puller.
482 Switches.

490 Tanks, water.
Tapping mach's. See 375.
492 Tar.
494 Tents.
496 Ties, steel.
498 Tile.
Traction engines. See 166.
500 Tracing cloth.
502 Trench braces.
504 Trench machines, and excavators.
506 Turntables.

510 Valves, steam.
512 Valves, water.
513 Vault lights.
514 Ventilators.

520 Wagons, dump.
522 Waterproofing.
Well drills. See 138.
526 Wheelbarrows.
528 Wheel scrapers.
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532 Wire cloth.
534 Wire rope.

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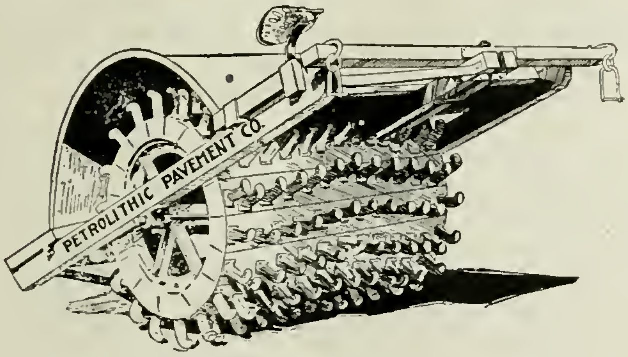
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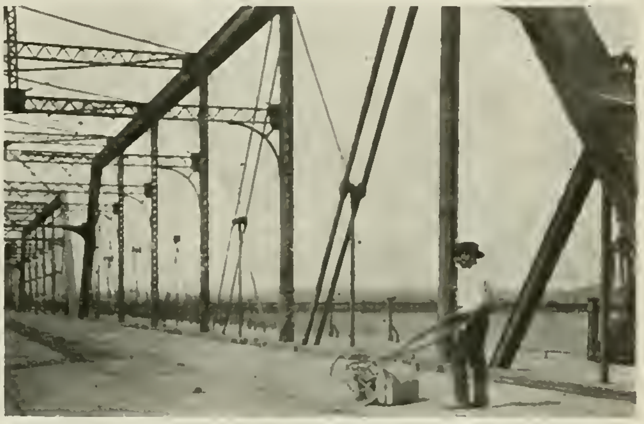

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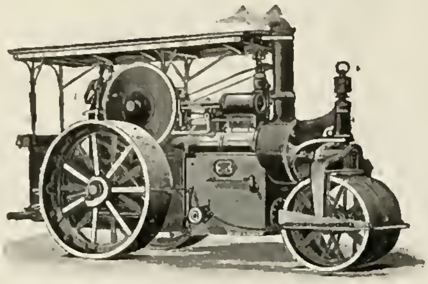

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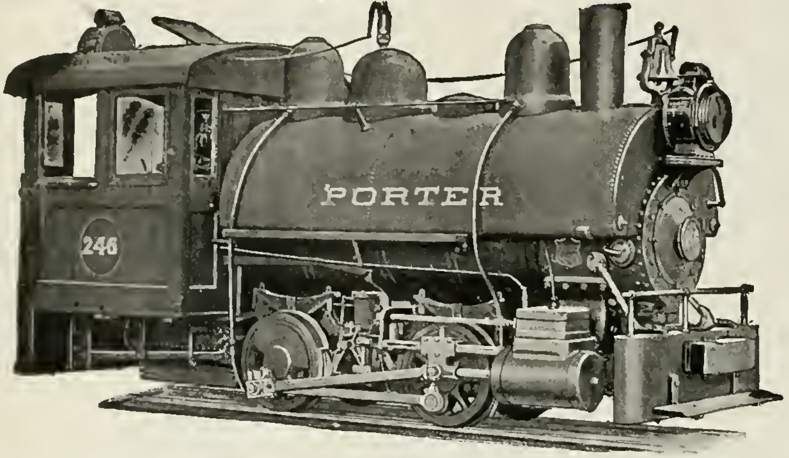

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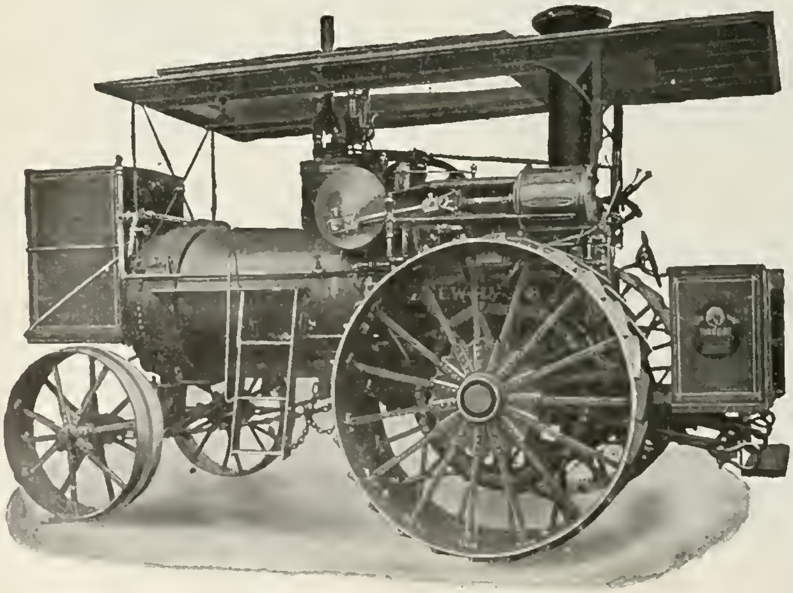

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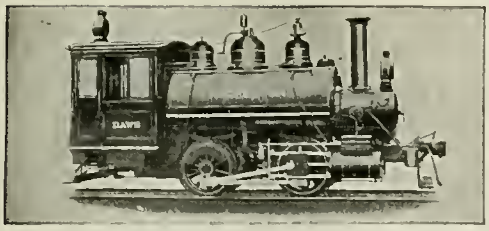

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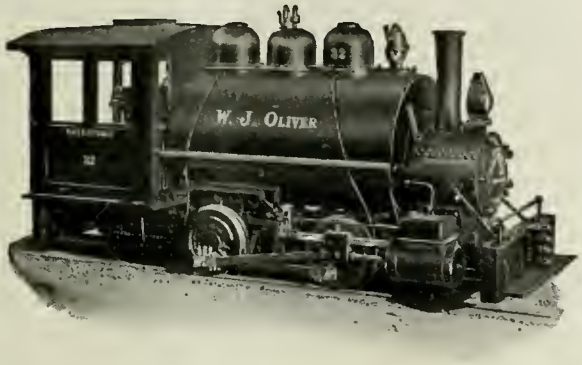

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If you will glance over the following titles of some of the articles recently published in Engineering-Contracting, you will understand why it is called the "Methods and Cost" paper. It has also been called a serial sequel to the "Handbook of Cost Data," for the managing editor of Engineering-Contracting is also the author of the "Handbook," and a great proportion of the articles in Engineering-Contracting are along the same lines, describing methods and giving actual costs of construction. Gillette's "Handbook" has broken all records for the sale of an engineering book, over 10,000 copies having been sold in less than two years. In like manner, Engineering-Contracting has broken all records for growth of an engineering paper. This is a periodical for contractors and for civil engineers engaged in construction. Judge for yourself by the following titles. Nor do the titles deceive as to the real contents of the articles:

How to Increase the Output of Men Digging Trenches.

Notes on the Cost of Bridge Erection.

Methods and Cost of Trench Excavation with a Trench Machine.

The Construction and Cost of a Small Pile Driver.

How to Increase the Output of a Rock Crusher by Feeding from a Bin.

Cost of a Stone Arch Culvert, Including Excavation and Timberwork.

Itemized Cost to the Contractors of the New York Subway for Earth and Rock Excavation, Bracing, Concrete, Waterproofing and Steel Work.

Notes on the Cost of Erecting an Iron Bridge, Including the Cost of Masonry Abutments.

Cost of Labor and Materials in Building Two Electric Railways.

Cost of Keeping on Contract Work.

Methods Used to Reduce the Cost of Drilling at the Wabana Iron Mines; Also the Cost of Drill Repairs.

Cost of Earth and Rock Excavation on the Panama Canal.

Methods and Cost of Driving Wakefield Sheet Piling in the Construction of Intercepting Sewers at Chicago, Ill.

The Itemized Cost of Earth Excavation on Seven Jobs: One Cellar, Two Foundation Pits, Reservoir Trench, and Widening Two Basements.

Method and Cost of Constructing Cement Pipe in Place.

The Cost of Brickwork in the Construction of Five Buildings Forming Part of a Manufacturing Plant.

The Detailed Cost of Earth Excavation with Elevating Grader on Seven Railroad Jobs.

The Cost of Digging a Cellar, Using a Steam Shovel and Dump Wagons.

Itemized Labor Cost of Asphalt Pavement and Stone Curb, Including Earth Excavation and Concrete Base.

The Cost of a Small Rock Tunnel.

The Labor Cost of Brickwork in a Railway Repair Shop.

Methods and Cost of Building a Reinforced Concrete Pipe Line for a Water Main.

Cost of Filling a Trestle Using Steam Shovel and Cars.

Labor Cost of a Brick Sewer in Chicago.

Methods and Cost of Rock Excavation for Sewer Trenches in St. Louis.

Methods and Cost of Sinking an Artesian Well.

Cost of Driving Piles for Bridge Renewals.

Cost of Driving Some Steel Sheet Piling.

A Flexible Cost Keeping System.

Cost of Quarrying, Crushing and Concrete Work and Foundations for a Cement Plant.

Labor Cost of a Granite Block Pavement, Stone Curb, etc., in New York.

Cost of Driving Piles for a Shore Protection.

Cost of Waterproofing with Tar, Felt and Asphalt as Compared with Sylvester Wash.

Method and Cost of Constructing a 13½-ft. Sewer Tunnel, Using a Hydraulic Shield.

Methods and Cost of Laying Vitrified Conduits for Electric Wires.

Methods and Cost of Treating Roads with Tar and Oil.

Estimating the Cost of Macadam.

Cost of Two Pneumatic Foundations for the Williamsburg Bridge, New York City.

Cost of Excavating Water Soaked Earth, Using the "Bleeding Method" of Unwatering the Site of the Work.

Method and Cost of Constructing a Reinforced Concrete Sewer.

Cost of Dredging in U. S. Government Harbor and River Work.

Methods and Costs of Two Railway Resurveys.

Methods and Cost of a Level Survey for a Drainage Plan.

Methods and Cost of Driving a Small Rock Tunnel.

Cost of Excavating an Asphalt Pavement and its Concrete Base.

The Cost of Repairing Asphalt Pavement in Various American Cities.

Methods and Cost of Laying Asphalt Block Pavement.

Methods and Costs of Cement Pipe Sewer Construction.

Standard Designs of Reinforced Concrete Culverts on C., B. & Q. Ry.

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Methods and Cost of Hydraulic Dredging, Ambrose Channel, New York Harbor.

Methods and Cost of Constructing Two Concrete Foundations for Drawbridges.

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Methods and Cost of Making Diamond Drill and Wash Borings Near New York City.

Method and Cost of Driving Steel Sheet Piling for the Cut-off Wall of a Concrete Dam Founded on Sand.

Method and Cost of Finishing Concrete Surfaces by Rubbing.

The Design of Economic Centers for a Reinforced Concrete Arch, the Cost of Same, and the Cost of Placing the Steel and the Concrete.

Methods and Cost of Loading Dump Wagons with Scrapers and the Design of a Loading Platform.

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Cost of the Brooklyn Anchorage of the Williamsburg Bridge, New York City.

Methods and Cost of Constructing a Tunnel Through Clay by the Shield Method, Lawrence Ave. Intercepting Sewer, Chicago.

Methods and Cost of Laying a Submerged Cast Iron Pipe.

Methods and Cost of Driving Raymond Concrete Piles for a Building Foundation.

Methods and Cost of Molding Concrete Culvert Pipe, Chicago & Illinois Western R. R.

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Methods and Cost of Constructing a Reinforced Concrete Reservoir at Fort Meade, S. Dak.

Methods and Cost of Clearing and Grubbing Land and Blasting Stumps.

Cost of Mine Haulage by Mules and by Electric Locomotives.

Concrete Block Construction for Residences, Methods and Costs.

Methods Employed in Laying Three Submerged Pipe Lines.

Methods and Cost of Making Diamond Drill Borings. Deep Waterways Surveys, Great Lakes to Atlantic Tide Waters.

Cost of Diamond Drill Borings in the Colorado Coal Measures.

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Contract Prices for Stone Road Construction in New Jersey.

A Code of Instructions for Inspecting and Supervising Reinforced Concrete Construction Work.

Possibilities and Methods of Pulling Steel Sheet Piling.

Method and Cost of Reconstructing a Steel Smoke Stack 100 ft. High.

Methods and Cost of Constructing and Maintaining Oyster Shell Roads.

Methods and Cost of Operating Pile Drivers and of Driving Steel Sheet Piling.

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Examples of Surface Finish in Concrete Bridge Work at Philadelphia.

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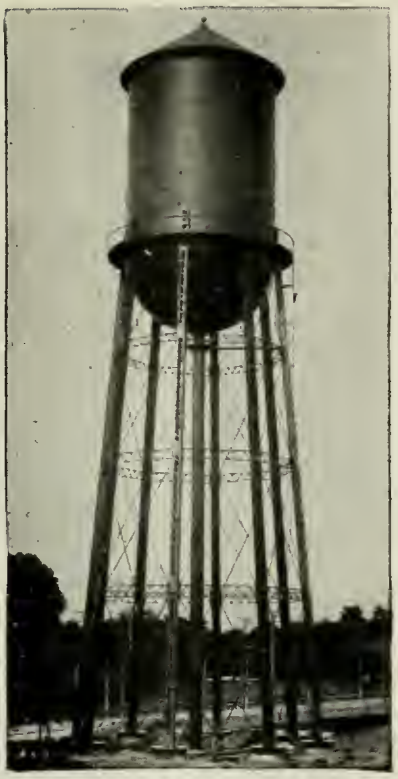

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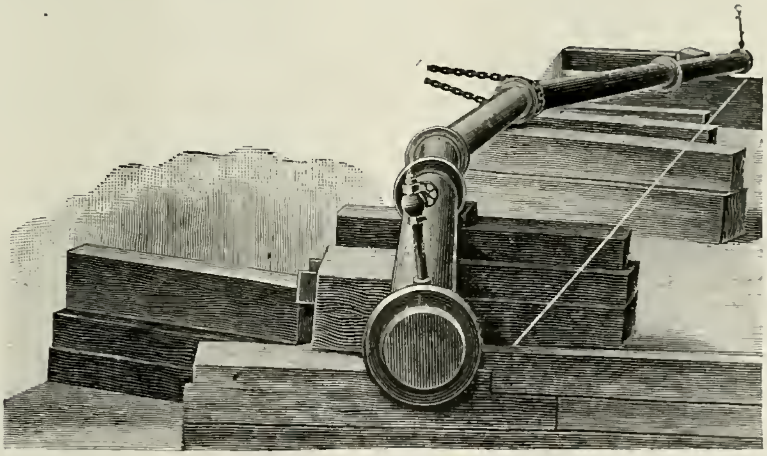

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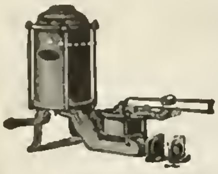

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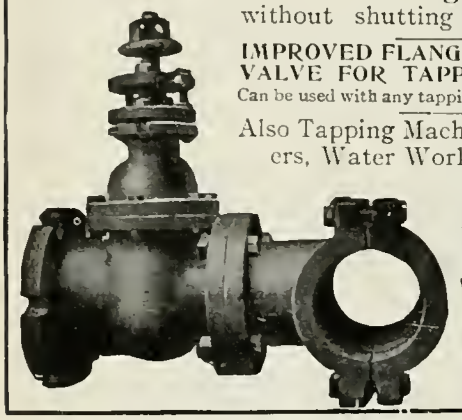

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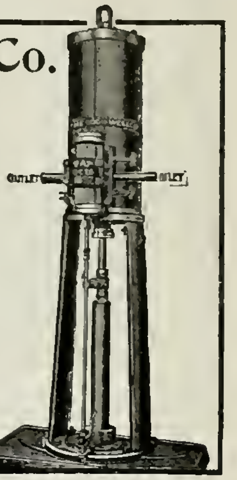

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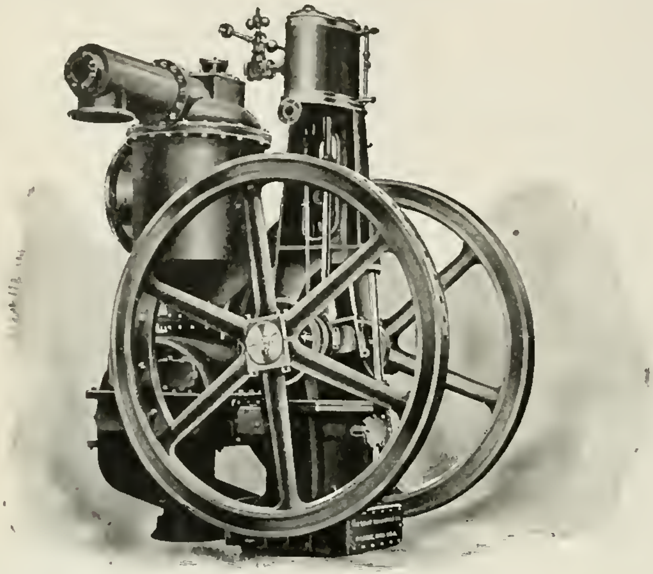

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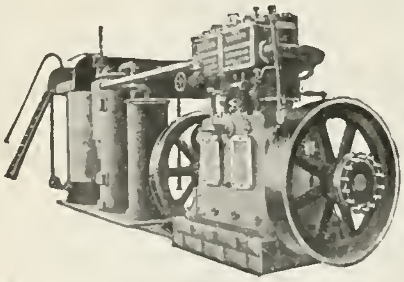

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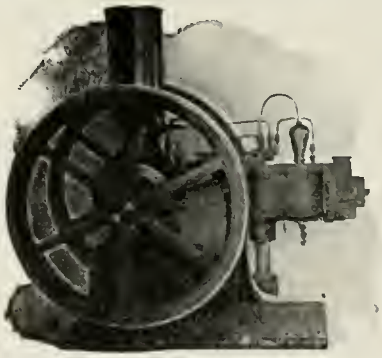

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Concrete Pipe Construction. We publish in this issue the first part of an interesting article describing the method and cost of constructing a reinforced concrete pipe line by day labor for the U. S. Reclamation Service work in connection with the Salt River project in Arizona. The method of constructing this pipe line is described fully and presents some unique features. In our next issue we shall give in some detail the cost of this pipe line, together with editorial comment on the comparative efficiency of the day labor and contract systems for such work and a valuable record of leakage tests on concrete conduit.

Cost of Bunk Houses on Contract Work Elsewhere we give the itemized cost of five section houses. These houses are somewhat better than those usually erected by contractors for the temporary occupancy of laborers. Nevertheless the data given in the article referred to should prove valuable in estimating the probable cost of bunk houses or cheap "office buildings" such as contractors erect.

Proposals and Engineer's Estimate.

It is a common practice among engineers to reject bids because they have exceeded the estimate of the cost of the work, as made up by themselves and their assistants. In many cases the bids may be nearer the actual worth of the work than the engigineer's estimates.

Generally speaking, engineers base their estimates on prices of similar work that they have had done, which in many cases are misleading. Contractors make their prices up from the experience they have had on previous work, taking into consideration the local conditions that will affect the job as well as the things they can foresee that will affect their work. This last consideration is an important one, and too often overlooked by engineers.

An illustration of this can be found when a job of magnitude is to be done, and it is divided into a number of contracts. The first few contracts may be awarded at what are considered reasonable figures by the engineers, but, after these contracts are awarded, the demand for labor, materials and machinery becomes so great as to increase the prices on contracts let subsequently. To reject bids then, owing to their being considered high, is to be condemned.

Then, too, it is a great hardship to contractors to have to spend their time and money and not obtain results, through no fault of their own. On a large job the cost of bidding frequently amounts to thousands of dollars, and inasmuch as engineers' estimates are generally guarded with great care to prevent bidders from seeing them, the contractor has no means of knowing whether his bid will be considered excessive or not.

If the engineer's estimate is not to be given to the bidders, bids should not be rejected for being higher any more than for being lower than the estimate.

The best result should be obtained by giving each bidder a copy of the engineer's estimate. If the contractor thinks, upon looking the estimate over, that it is too low and that he could not bid within it, he will waste no more time upon the matter; but, if he believes the estimate is reasonable, it will be a great help to him in getting up his bid. For then he will have the benefit of the labors and opinion of the engineer as well as his own. Money should thus be saved to both parties of the contract.

In making proposals a second time on a contract those who have previously bid feel that they have been put to a great disadvantage by having had their prices made public. This is especially so of the lowest bidder. For these reasons, if engineers' estimates are to be used as a criterion for accepting or rejecting proposals, their estimates should be given out with all proposal sheets.

The Effect of the Eight-Hour Law on Laborers in Construction Camps.

In the fifth annual report of the Reclamation Service, Mr. F. H. Newell, chief engineer, has the following to say regarding the operation of the eight-hour law on the construction work now going on in the west.

"The eight-hour law has also been a source of difficulty and increased expense. Strict enforcement of the eight-hour law as practiced on the reclamation work, is adding materially to the cost of the irrigation works. It has not been found that the same amount of rock can be excavated, or earth be moved, or concrete placed, in an eight-hour day as in one of nine or ten hours. But the laborer expects to earn as much in eight hours on government work as he does in a longer day in a railroad camp, and he drifts away whenever there is material difference in the amount of the daily wage. It has not yet become evident that the enforced additional leisure is appreciated. The general feeling among the laborers appears to be that work is work, so much per hour, and the ordinary laborer prefers to be at work—pay being proportional to hours of work—rather than to be forced into idleness, especially with the uncongenial surroundings of a construction camp remote from home or places of amusement. This appears to be particularly true of the conditions that prevail during the summer in the Southwest, where there is more complaint of heat and hot weather while men are idle than while they are at work."

This is a very frank and explicit statement, and ENGINEERING-CONTRACTING can without hesitancy approve every word. When men are doing work in a city and return to their families every evening the number of hours worked is of importance to them, but it is even doubtful if they would prefer the eight hours to the ten, with less pay. When men are living in a construction camp, they are there to make

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money and they do not object to working long hours provided they are paid for them. In many parts of the South the writer knows of contractors who work their men, during the summer season, as long as fourteen hours and the men are well satisfied. In many cases workmen do not object to being employed on Sunday rather than put in the day loafing around the camp.

Every contractor and engineer knows that on construction work when prolonged spells of inclement weather occur, laborers become dissatisfied, and if one or two start to leave a camp, they are followed by many others. A large number of men living together far from their homes and away from towns and cities, where they can find healthy amusement, must be kept employed except for the time necessary to eat and sleep, if they are to be contented, or kept out of mischief or from crime.

It is also true that a man cannot do as much work in eight hours as he can in ten, yet he will want and often gets the same pay. Thus if the contractor has considered this, the public is paying an increased price for their work.

Along the Mississippi river the commissions in charge of levee construction have let this work to contractors, who have worked their men from sunrise to sunset. It has been a hard fight for years for the various states to raise money to carry on this work, to protect the farming land and the homes of thousands of people from floods. Much of the work that has been done has not even been on a cash basis, and there are still millions of yards of earth to be placed in the levees. The cost of all of this will be increased by the eight-hour law.

The chief engineer of one of the state boards in charge of levee construction, writing to a member of our staff, says: "The government proposes to adopt the eight-hour law for this character of work from the present time. The eight-hour law has never heretofore been enforced on the levee work. The contractors have usually worked about 12 hours a day. I think this will increase our present prices for future work about 25 per cent for the government work, and that will have its effect on the work being done by different state organizations—as this board. I think our state or levee board work will advance about 10 per cent from this cause, although we will continue to work from daylight until dark."

After fourteen years' experience on the river this gentleman should know whereof he writes. Congress would do well to curtail the eight-hour law so that it shall apply only to work done in cities.

Such facts as these show the need of an American society of engineering contractors. If such an organization had been in existence before this law was passed, they could have had a voice in its framing. Now they can be of assistance in having it revised so as to protect themselves and the general public.

Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Methods and Cost of Constructing a Reinforced Concrete Pipe for Carrying Water Under Pressure.*

BY CHESTER WASON SMITH, ASSOC. M. A. SOC. C. E.

This paper describes the construction of about 6,000 ft. of reinforced concrete pipe intended to carry water under pressure; and also gives the results attained and some figures as to the cost. The work was in charge of the writer.

HISTORY AND CONDITIONS.

A prominent feature of the Salt River project, in process of construction in Arizona by the United States Reclamation Service, is a canal 19 miles long, having a capacity of 250 cu. ft. per sec. This canal is to furnish power to build the Roosevelt Dam, run the cement mill furnishing the cement therefor, and later, pump water for additional irrigation, in the vicinity of Phoenix.

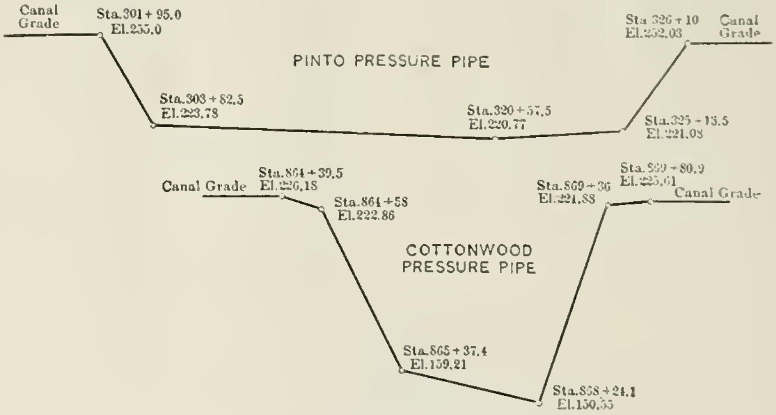

Fig. 1—Profiles of Pipe Line Crossings of Pinto and Cottonwood Creeks.

At Livingston, about six miles below the canal intake, the canal crosses Pinto Creek, at that point nearly one-half mile wide, and about 25 ft. below the canal grade.

The crossing of Cottonwood Canon is 2½ miles above the Roosevelt Dam, which is at the lower end of the canal. The crossing is 250 ft. wide on the bottom and 75 ft. below the canal grade. Pinto Creek has a water-shed of 190 sq. miles. At the canal crossing its grade is about 1 per cent and the material there is sand with a little gravel and small cobbles. At the Cottonwood Crossing the canon has a water-shed of about 4 square miles. The grade of the creek is about 4 per cent and the material is boulders and gravel. Both creeks are dry nearly all the time, except for a small underflow, but they are subject to occasional large and sudden runoffs, characteristic of the flow from mountainous water-sheds which lack vegetation.

It was decided to make each crossing with two lines of reinforced concrete pipe, circular inside, and 5 ft. 3 in. in diameter, giving the Pinto Crossing an effective grade of 2.97 ft. in 2,415 ft., and the Cottonwood Crossing 0.57 ft. in 541.4 ft. The pipes are buried under the creek, their tops being from 2 to 5 ft. below its bed. Fig. 1 shows the profiles of the pipes at each crossing, the water level in the canal at full capacity being 5½ ft. below the canal grades noted. Fig. 2 is a cross-section of the Pinto pipe (2.254 cu. yds. per lin. ft.—Ed.). The concrete in the Cottonwood pipe is 7 in. thick; there are ten longitudinal rods, and the spacing of the rings is 7 ins. c. to c.

The reinforcement, longitudinal and transverse, consists of ⅝-in steel rods, having an ultimate strength of 62,000 lbs. and an elastic limit of 30,000 lbs. per sq. in.

At Pinto Creek there was excellent sand and gravel at all points in the excavation; the water used in the concrete for the first line of pipe was pumped from the trench (the trench intercepting the underflow of the creek), and the first pipe was tapped to furnish the water used in building the second one. At Cottonwood the sand and gravel, and nearly all the water, were hauled about ¾ miles from Salt River.

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*A paper read before the American Society of Civil Engineers and printed in the Proceedings for August, 1907.

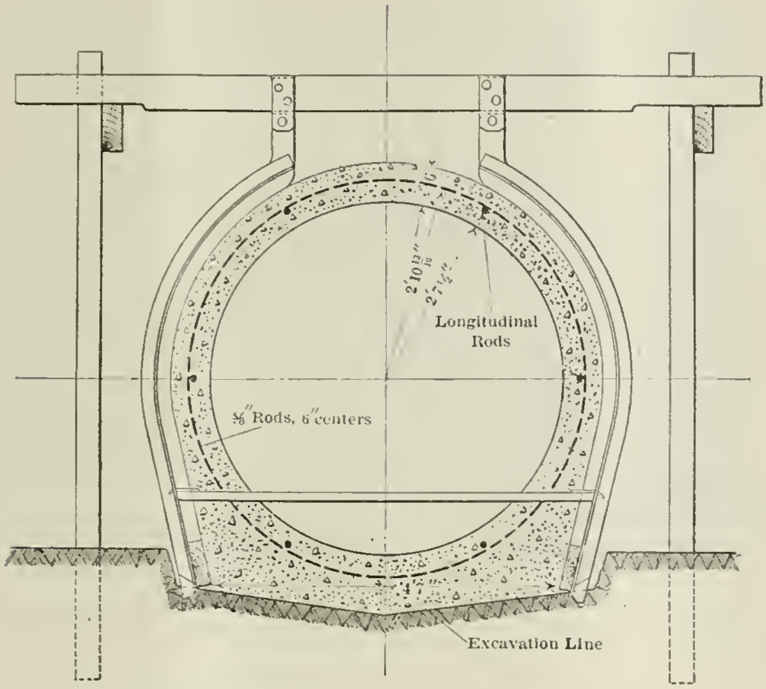


Fig. 2—Cross Section of Pinto Creek Pipe Line.

The concrete was composed of 1 part of Portland cement, 2½ parts of sand, and 4 parts of rather fine gravel, and was mixed by hand, quite wet, on platforms of boards about 150 ft. apart along the trench.

The first length of 200 or 300 ft. of pipe was made in June, 1905, with cement purchased from the Portland Cement Company, of Denver, Colo. This was an average Portland cement. A progress of 120 ft. per 24 hours was easily attained with a comparatively raw gang.

Afterward, the cement used was the product of the mill installed and operated by the Reclamation Service to furnish cement for building the Roosevelt Dam.

During the summer and fall of 1905 nearly the entire output of this mill was required by contractors for various other work along the canal, and work on the pipe was frequently interrupted for considerable periods of time.

On account of lack of cement, also, on account of several floods, the completion of the first line of pipe across Pinto Creek was delayed until the middle of November, 1905.

As one line would carry all the water needed to furnish power for building the dam, and as power was required as soon as possible, the forms were then moved to Cottonwood, where the two lines were constructed. In March, 1906, the construction of the second line at Pinto was started, but, owing to various delays not connected with the construction, this line was not completed until about Aug. 1. Much of the time during the construction of both Pinto pipes the temperature was more than 100° F. The Cottonwood pipes were constructed entirely in winter, when the temperature was between 35° and 50° F.

The cement manufactured at Roosevelt, while excellent as regards strength and soundness, has been extremely slow setting. An average sample would test about as follows: Fineness: 95 per cent passed the 100-mesh sieve and 76 per cent passed the 200-mesh. Setting: Initial, 4½ hours; final, 12 hours. Tensile strength: Neat, 7 days, 450 lb.; 28 days, 550 lb.; 3 months, 625 lb.; 1 part cement to 3 parts standard sand, 7 days, 100 lb.; 28 days, 200 lb.; 3 months, 260 lb.

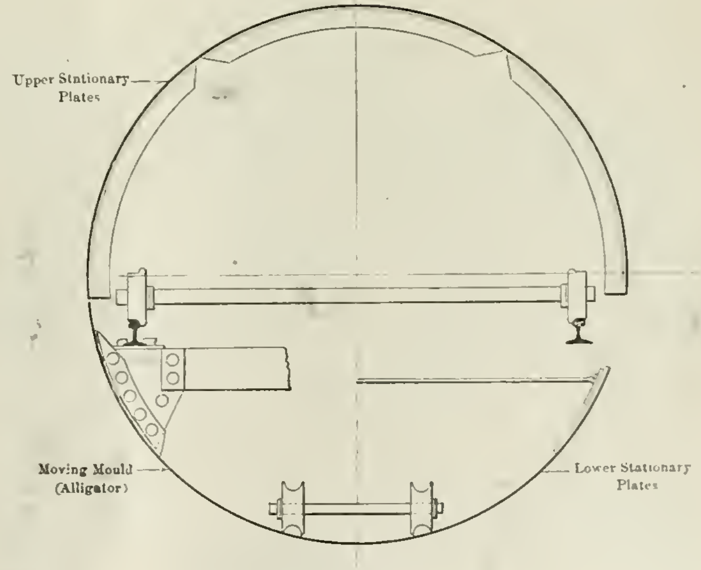


Fig. 3—Movable Form for Building Reinforced Concrete Pressure Pipe.

A 6-in. concrete cube was made of the materials used in the pipe, except that the proportions were by weight, 1 cement, 2½ sand, and 4½ gravel, mixed with about the same proportion of water. The batch from which the cube was made was composed of 1,200 g. of cement (of which only 64 per cent passed the 200-mesh sieve), 3,000 g. of sand, 5,400 g. of gravel and 720 g. of water. This cube, after having set for 3 months in water, was crushed at 58,180 lbs. or 1,644 lbs. per sq. in. This rather low result was due partly to the coarseness of the cement, and partly to the fact that such a wet concrete was slow in attaining its strength.

With such cement, and 70 lin. ft. of upper stationary plates, it was found that not more than 70 ft. of pipe could be made in 24 hours without getting into difficulties when the plates were removed, as patches of concrete would fall out or peel off with them. With cooler weather, the difficulties increased; accordingly, on the completion of the first line across Pinto Creek, the idea of continuous work was abandoned, and work on the Cottonwood lines and the remaining Pinto line was done with one 8-hour shift per day.

On the Cottonwood lines, built in December and January, it was found that only 24 ft. of pipe per day could be built, thus allowing 3 days for the concrete to harden before removing the plates. The second Pinto line, constructed in warmer weather, was built at the rate of 40 ft. per day.

MOVABLE FORM.

It was considered desirable to work continuously on the pipe, with three 8-hour shifts, in order to avoid, as far as possible, transverse joints, and consequent probable opening between the work of different days. To facilitate continuous work, a movable form was designed and introduced on the work by F. Teichman, M. Am. Soc C. E., Designing Engineer in the Reclamation Service.

Briefly described, the form, as shown in Figs. 3 and 4, and the photographs, Figs. 5 and 6, is as follows: A steel semi-cylinder, called "the alligator," forms the inside of the lower half of the pipe; this piece is pulled along by a cable from a horse-power whim in the trench ahead. It is kept to line and grade by a steering apparatus, extending about 8 ft. in front of its nose, and either rolling or sliding on a light wooden track previously laid. The inner form for the upper half of the pipe consists of steel semi-cylinders in 2-ft lengths, each in three pieces, that is, hinged at two points, to facilitate moving and erection.

These upper stationary plates are bolted together, end to end, making a continuous form, from the front end, where concrete is going in, to the rear end, where the concrete has set sufficiently to permit their removal; they are supported by rollers on a track which is part of the alligator, the alligator thus rolling out from under the upper stationary plates. Immediately behind the alligator are introduced lower stationary plates in 2-ft lengths, one plate being inserted as often as a length of 2 ft. invert is exposed. On the withdrawal of the alligator, an upper stationary plate is thus supported by the plate ahead on the alligator and a plate behind on a lower plate, until the insertion of its lower plate. Upper and lower plates are removed at the rear end and sent ahead on a small truck hauled back and forth with a rope, on a track in the bottom of the lower plates and alligator.

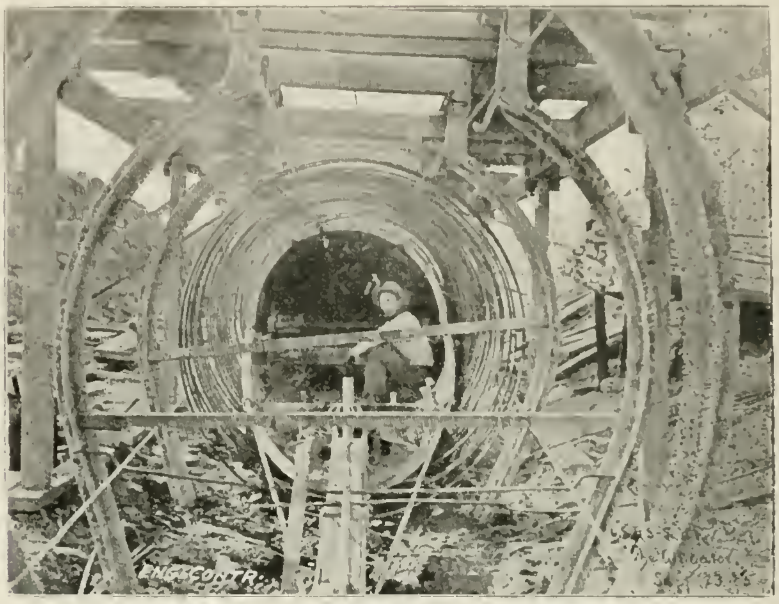


Fig. 6—The "Alligator," Used in Building Reinforced Concrete Pressure Pipe.

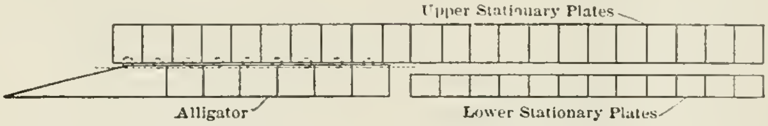


Fig. 4—Diagram Elevations of Movable Forms.

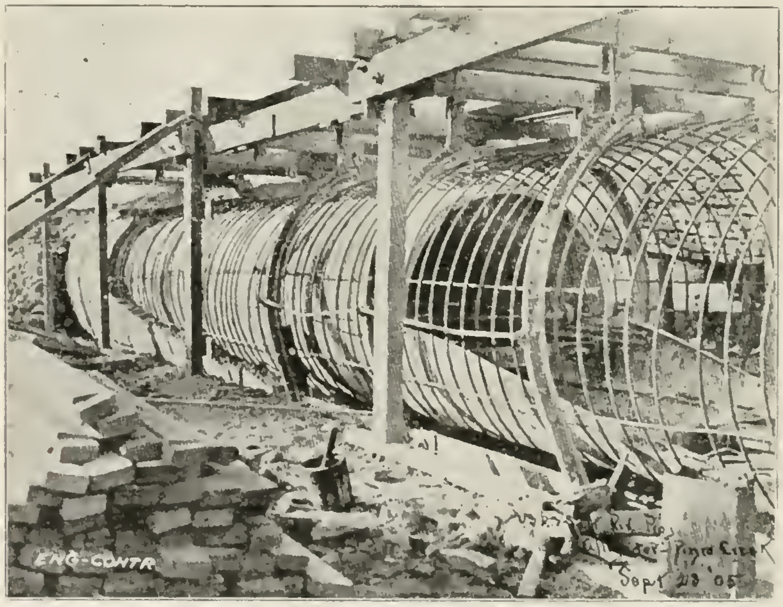


Fig. 5—The "Alligator," Used in Building Reinforced Concrete Pressure Pipe.

The outside lagging was of 2½-in. lumber in narrow pieces, about 5½ ft. long, laid on the same slope as the nose of the alligator (1 in 4) between iron ribs hung from a wooden superstructure. This superstructure also carried the runways for wheeling out the concrete.

CONSTRUCTION.

The rings were bent to the desired circumference by a small bending machine. The ends were not upset or welded, but merely lapped about 15 ins. and tied with baling wire; they were also wired at each crossing with, each longitudinal rod, in order to hold them in place while the concrete was being put in.

The concrete was made with fine gravel and mixed, quite wet, in order to be worked into the narrow space between the reinforcement and the forms completely and easily. It was brought out in wheelbarrows on top of the superstructure and dumped wherever desired along the working face, that is, from the bottom of the pipe at the nose of the alligator, back on the 1 in 4 slope to the top of the pipe at the third or fourth upper stationary plate. One or two small chutes were found desirable in connection with the dumping.

Two men on each side, provided with small wooden paddles, churned the concrete to make certain that all voids were filled, and to prevent any nesting of the gravel. These men also introduced the outside lagging, that operation and the moving ahead of the alligator being regulated so that the working face was from 0 to 8 or 10 in. below the forms. On stopping work for the night, or if the continuous operation was interrupted for any reason, the blocking off was done at right angles to the axis of the pipe. This was done by stuffing sand bags between the inner and outer forms. This was more convenient than the use of a wooden stop, and afforded a rougher surface with which to bond when work was resumed.

The pipe was wet down on the outside for about a week after completion, and, as far as possible, the back-filling was kept up to the watering.

Some smoothing and pointing was necessary inside the pipe, and one or two brush coats of neat Portland-cement grout were applied; but no plaster coat was put on, nor was any water-proofing materials used.

DIFFICULTIES.

It was difficult to overcome the tendency of the alligator to twist and travel off line or grade, and the steering apparatus was designed to prevent this, it not having been a part of the original form. It did much toward correcting the eccentricities in the travel of the alligator, but, at best, much depended upon constant watchfulness, and it was found necessary to stop work once in 8 or 10 days in order to level and straighten it out.

It is very doubtful if a uniform thickness could have been attained, even had an attempt been made to shift and adjust the outside forms and the reinforcement to correspond with the movements of the alligator. With this form, the minimum thickness will be at least 1½ ins. less than the average thickness.

Considerable trouble was caused by the concrete peeling off with the upper stationary plates; particularly—in fact, almost solely—with the middle segment of the plate. Large patches, often an inch or more in depth, would come off with the plate.

To overcome this, various schemes were tried; soft soap or crude oil was applied to the plates immediately before covering them with concrete; particular care was taken to allow no spatterings of concrete to accumulate on the plate and dry out in advance of covering it with the mass of concrete; variations in the quantities of water in the concrete were also tried. Experience seemed to show that the only satisfactory remedy was to allow the concrete to set more thoroughly before removing the plates; if given sufficient time, a perfect surface was obtained. No special precautions were taken to guard against transverse joints between the work of different days, but, when an end was to be left for more than one day before resuming work, extra longitudinal rods were inserted, extending about 2 ft. into the work on each side of the joint.

RESULTS.

Transverse Joints.—On the first Pinto line, where there were few interruptions to continuous work, and where a portion of it was built in comparatively cool weather, there were very few transverse joints worthy of mention, and none requiring any treatment. On the two Cottonwood lines, built in the coldest weather, none has been observed.

On the second Pinto line, built entirely during the hottest weather, with about fifty interruptions to continuous work, and first filled in cold weather, it was to be expected that the transverse joints would be larger in number and size. At about forty of them there was a perceptible crack; of the forty cracks about twenty-five were 1-16 in. or more in width, and were repaired, some of them before the pipe was first filled, and the remainder afterward. In general, they were more frequent and pronounced in one or two sections where the watering of the pipe was discontinued before the back-filling was done.

Individual Cracks.—When the pipes were put in service, some longitudinal cracks, from 1-16 to 3-16 in. in width, developed (see leakage tests in Tables 2 to 5), and at first various possible causes or contributary causes were assigned to them:

First, they were ascribed to the water hammer, which was considerable when the pipes were being filled.

Second, it was thought that the excavation of the trench for the second line of pipe (10 ft. from center to center of the first line) threw an eccentric load on the first pipe. This undoubtedly had an effect on the cracks in the first Pinto pipe, and, as soon as it was observed, the remainder of the second pipe was moved 10 ft. further away.

Third, the cracks being invariably in the top of the pipe, and within a few inches of the center, it was thought that possibly the laps in the reinforcing rings had been put in on that line, and that the rods, or some of them, had parted from the concrete. Enough evidence was at hand, however, to show that the laps had been properly staggered. If such had been the cause, a longitudinal crack developing in a few hours to 200 or 300 ft. long, would have resulted in the total failure of that portion of the pipe.

The true reason is undoubtedly as follows: The concrete shrank in the process of setting; this was resisted by the steel rings, thus producing a condition in which the steel was in compression and the concrete in tension. Therefore, on filling the pipe, the concrete took the entire load until it failed, and then the steel took the load.

That the cracks were invariably in the top of the pipe was probably due to the fact that the lower third of the pipe was in sand kept wet by the underflow; in effect, this lower part set under water, and the shrinkage was relatively small.

A careful inspection of the inside of the pipe showed that, wherever the crack occurred, the single large crack was the only one: and at points where there was no large crack, the upper two-thirds of the inside suface showed a network of very minute cracks.

These were from 1 to 4 or 5 ins. apart, and generally so fine that they could have had but a very insignificant effect on the leakage, and, in fact, they were only detected by the presence of a minute line of the finest sediment which was deposited ar the crack without passing through.

The writer is of the opinion that the minute cracks existed previous to the filling of the pipe, consequently, that at those places the steel carried the load immediately upon its application; however, there is no way to verify this. Repairs were made (on the inside of the pipe) in the following manner: each crack was cut out to a depth of about 2 ins. and as narrow as possible, 1 in. of oakum was then caulked in tightly, and over that, the joint was pointed with stiff mortar. In addition, grout was run into the crack from the outside.

Several observations have been made for the purpose of determining the value of n, in Kutter's formula, and, while the entire series contemplated has not been made, the observations on the Cottonwood pipes, thus far, show that $n = 0.012$, approximately.

In considering the results of the leakage tests, it should be borne in mind that Salt River carries considerable sediment. Observations at Roosevelt have shown that the quantity varies from a mere trace up to 4 or 5 per cent. Practically, the water is never without some sediment, but the maximum occurs only during the highest floods; the average would be between one-fourth and one-half of 1 per cent.

Between Roosevelt and the canal intake, considerable quantities of the sediment, at ordinary stages of the river, settle in the flat reaches, so that at the intake, while the maximum quantity of sediment is not more than at Roosevelt, the average is undoubtedly greater.

At several points along the canal there are mud boxes from which more or less sediment is occasionally sluiced, but the canal carries a larger percentage of sediment than the river, except when the latter is in flood.

(To be continued.)

A decree has been published authorizing the Governor-General of French West Africa to raise a loan of $20,000,000 for public works, and notably for the improvement of the water supply of Dakar.

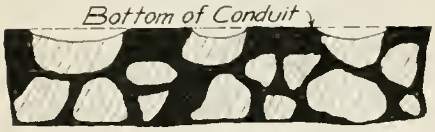
The average fire loss in the United States is said to be more than $2 per head of the population, as compared with only one-third of a dollar in six of the leading European countries. The difference is ascribed to less rigidly enforced building laws.

The city government of Milan, Italy, has voted to obtain a loan of $13,510,000. The money is to be used in making municipal improvements, such as building sewers, public baths, tramways, electrical plant, new streets, etc.

The Action of Soft Water on Limestone Concrete.

In a recent volume of the Proceedings of the Institution of Civil Engineers, M. R. Barnett, M. Inst. C. E., has a paper on a limestone concrete aqueduct, in which a deterioration of the concrete was caused by the soft water carried in the culvert.

The aqueduct was built in 1894 to carry water to the city of Manchester, England. After a number of years it was found that the full amount of the water that should have been delivered by the conduit, was not being delivered, and an examination was made to discover the leaks. These were found in the concrete culvert portion of the aqueduct over a length of three miles. Here the culvert ran through a limestone section, and the concrete had been made of a pure limestone, which, of course, is readily soluble, particularly in water charged with carbonic acid gas, or containing vegetable acid. When the water was drawn from the culvert it was discovered that wherever the water had access to the limestone in the concrete, the stones were worn away into a concave shape, all the stones being hollow, while mortar surrounding the stones remained good and stood up round each stone as shown in the accompanying sketch. Small stone in the mortar that were not affected. The side walls had suffered like the floor. In some places holes were found entirely through the concrete.



Sketch Showing Effect of Soft Water on Limestone Concrete.

(Portion in solid black indicates mortar. Portions cross hatched indicate limestone aggregate.)

To be certain that this deterioration was caused by the chemical action of the soft water the author of the paper had analyses of the water made and carried on experiments with samples of limestone and concrete in this water for six months, these tests showing beyond doubt that the leakages were caused as stated.

To repair the culvert, the old work was hacked away to at least the depth of an inch, and forms built in the culvert just as they had been when it was constructed and a mortar of 1 part cement to 1 part sand, was mixed and put in place with small shovels and trowels. The mortar was then worked down well in place with the trowels and the forms tapped upon with these tools until the air was expelled from the mortar. The culvert was large enough for men to work in it with some degree of ease.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Criticism of a Clearing and Grubbing Specification.

Specifications frequently contain paragraphs that stipulate provisions that at first glance seem customary and extremely innocent, when in reality there is a "negro hid in the brush pile." The following clause is copied from a set of specifications for railroad construction in the south:

"The surface of the ground to be excavated, and places where embankments occur not exceeding 2 ft. in height, shall be (between slope stakes) grubbed free from stumps, roots, brush and other perishable material as directed by the engineer."

The clause covering the grubbing under low embankments is one that is in common usage, but the beginning of the paragraph can cause trouble.

Railroad excavation, when it is earth, is commonly done with scrapers, elevating graders or steam shovels. When the first two methods are used, the contractor, in order to work either his scraper or his grader, must first grub the ground free from all stumps and roots. It is a different story when a steam shovel is operated. Then the shovel can dig up the stumps and load them on the cars as a part of the earth excavation. Should the engineer and contractor have a disagreement, and the engineer wish to put the "screws" on the contractor, such a clause affords him opportunity. Under it he can order the contractor to grub the ground before the steam shovel goes to work.

In like manner advantage can be taken of the contractor in rock cuts. Instead of waiting to blast the stumps out as the rock is excavated, the grubbing not only of stumps but also of roots can be ordered done by the engineer prior to the rock blasting.

"The surface of the ground to be excavated" will be made free from stumps and roots, no matter whether anything is said about it in the specifications or not, for the contractor can not escape doing so. This being so, it is superfluous to specify clearing, grubbing between the slope stakes, unless it is the intention to remove all vegetable matter from the materials that are to be used in making embankments. On railroad work it is not customary to remove sod or small roots from embankments or from the surface of ground to be covered by embankments, yet, under the strict letter of this specification a contractor can be compelled to do both.

It may be replied that no reasonable engineer would attempt to enforce the letter of this specification, but if a specification serves any useful purpose it is to *specify*, leaving nothing in doubt, nothing dependent upon the "reasonableness" of any one. In matters of this kind it is just as easy to be specific as it is to be vague, and far more satisfactory to all concerned, since all chance for quibble is removed.

Another point that is not always covered definitely is the matter of payment for grubbing. Where steam shovels are used it is becoming the custom not to pay for grubbing; but, unless the specification distinctly states that grubbing will not be paid for in steam shovel cuts, it is probable that a contractor could collect payment.

Ambiguous specifications of the sort under discussion foment trouble sooner or later, and cause some one an unexpected loss not merely of temper but of money. The American Society of Engineering Contractors will have no more important function than the standardizing of specifications, wherever standardization is possible.

Methods and Cost of Lining an Irrigation Canal with Cobble Stones and Plaster.

The protection of earth slopes from wash by means of slope wall paving is a subject about which very little has been written.

The following data appeared some years ago in the Transactions Am. Soc. C. E. in a paper by Mr. W. Hall, in which the lining of the Santa Ana Canal, in California, is described. The data are not as detailed as one might wish, but they are worthy of being placed on record in our columns.

The canal was lined with large cobbles and small boulders, the side walls being laid in mortar and faced with plaster to prevent loss of water by leakage, as shown in Fig. 1. The canal has a trapezoidal cross-section, but the lining is laid so as to give a curved bottom. The side walls were built first, and 20 per cent of the canal bottom was occupied by the footing of the side walls, thus throwing the lines of the invert out so as not to have a small base that might lead to settlement and the opening of cracks between the walls and the invert, through which water would escape.

The larger field stone were used at the base of the side walls. The walls were laid up in irregular layers, cement mortar being used for two-thirds their thickness, the rear third being filled with slightly wetted earth. After the mortar had hardened, the bottom was dug out with pick and shovel to admit the invert paving. This paving was closely bedded, dry, in coarse sand, and spalls were hammered into the joints. Gravel and sand were then spread over the pavement and swept in with rattan stable-brooms. The surplus was then swept off leaving open joints for half the depth of the stone. Mortar was then thrown on and roughly shoveled and troweled.

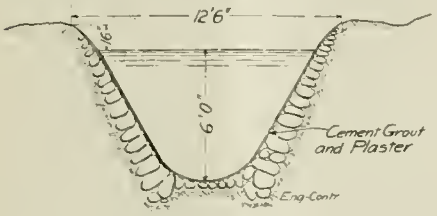


Fig. 1—Cobble Stone Lining, Plastered Inside.

After this had hardened, the side walls were plastered and finally the invert. The plaster was kept sprinkled for two weeks after laying.

In building the walls wooden profile frames were set 16 to 20 ft. apart, and lines stretched across to guide the men. Mortar was mixed in boxes at quarter mile intervals, delivered in wagons and subdelivered in wheelbarrows. The plaster was mixed in boxes on wheels, and was delivered through iron chutes down where needed. Common laborers were used throughout, as masons are too particular and too slow for this class of work. In considering this design of walls it is well to remember that there are no soaking rains in southern California, so that water does not accumulate behind the side walls.

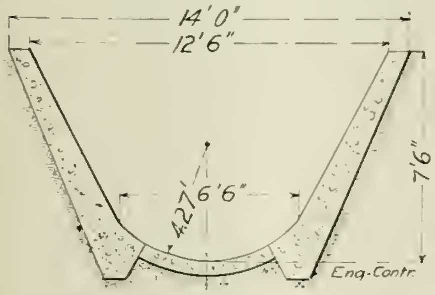


Fig. 2—Concrete Lining.

Some 7,600 ft. of canal were thus lined for $2.29 per lin. ft., of which $1.67 was for the side walls, $0.12 for the invert paving, and $0.49 for plastering the walls and invert. The work was done by company labor, wages being $2 a day for common labor, and $4 a day for team and driver, but due to delays in paying off the men they were fully 25 per cent less efficient than they would have been otherwise. The cement cost $3.50 per bbl. on the spot. Unfortunately the costs are not analyzed.

Sand boxes, or settling chambers, are provided to catch the sand carried by the water. A "sand valve" is provided (and described in detail), and it is stated that it has served well for years in other canals—for removing the sand from the settling basins.

About 4,400 cu. yds. of "third-class masonry" were required to line the canal, and in it were used 553 bbls. of cement at $3.50, and 811 bbls. of lime at $1.80 on the spot. The cost of this masonry averaged $2.95 per cu. yd., but it ranged from $2 where all materials, except the sand, were at hand, to about $4 where the haul was a mile or more. None of the stone for walls or invert was quarried, but was gathered from creek and river beds, and from the canal spoil banks, the average haul being probably about a mile.

There were 1,092 cu. yds. of bottom paving, averaging 6 ins. thick, and it cost $1.24 per cu. yd., or 2.3 cts. per sq. ft.; but the cost ranged from $0.60 per cu. yd., where all the cobbles were taken from the excavated material at hand, up to $2.40 per cu. yd. where the haul was long.

The Cost of Breaking Bou ders by Means of a Derrick and a Drop Hammer.

Breaking boulders into such sizes that the stone can be easily handled is quite a costly item of rock excavation. Any contractor who keeps a cost record of this work will be surprised at the results, the cost per cubic yard being higher than one would ordinarily expect. There can be little doubt that such records would mean the adoption of new methods of doing the work to reduce the costs.

In Gillette's "Rock Excavation," page 235, the following average costs of breaking up sandstone boulders by four methods are listed:

By sledging	5 cts. per cu. ft.
By mudcapping	36 cts. per cu. ft.
By blockholing	17 cts. per cu. ft.
By undermining	16 cts. per cu. ft.

It will be seen from this that the cheapest method is by sledging, but it must be remembered that the larger boulders cannot be sledged by a man, so when a boulder has a greater volume than ½ to ¾ cu. yd., unless there is a seam or crack in it made from previous blasting, or by its natural stratification, it must be broken up by one of the other methods, which means an increased cost of from 300 to 700 per cent.

In consequence of this, any contrivance that will break up larger boulders without resorting to the use of explosives will be welcomed by those engaged in rock excavation. Where derricks are used on jobs, such as quarries, cellar excavations, etc., the following device can be rigged up at a small expense, and the money it will save will quickly pay back the original cost.

A pear-shape weight, weighing from 1,500 lbs. to 3,000 lbs., made of cast steel, with an eye or ring in the end so it can be picked up, is raised by the derrick to a suitable height, and swung around until the weight is directly over the boulder to be broken, then by means of a line that is attached to a trip the weight is dropped on to the boulder, generally breaking it up at the first drop.

The pear-shape of the weight has the advantage over most other shapes in that it drops plumb. The weight of one ton is found very convenient for breaking most boulders.

With two derricks, one can place the boulders within reach of the other, which can break them up. At times the boulders are only broken in one or two pieces, but these pieces can be quickly turned over or placed by the derrick to be broken up small enough to handle. A man with a sledge will also break up some of the smaller pieces easier and cheaper than the derrick. With only one derrick the boulders must first be placed in favorable places for breaking, and after a number have been put within reach, the weight can be used to break them up.

The following work of this character was done by one of the editors of this journal. In a quarry, large boulders that were not considered fit for dimension stone, were broken up for the crushers. The rock was hard blue granite. The weight was of steel, weighing 1,500 lbs. It was raised 30 ft. before being tripped. The derricks were operated by steam, the cost per day of ten hours being:

One derrickman	$ 2.00
One engineer	2.50
Three men at $1.50............	4.50
Plant, etc.	1.00
Total	$10.00

This meant a cost per hour for operating derrick of $1.00 and per minute of 1 2/3 cents.

Steam for the hoisting engine was furnished from a central boiler plant that turnished steam for the crushers, several hoists, drills, etc. The allowance of $1 is made for this and plant depreciation.

In working the quarry a pile of refuse boulders amounting to 200 cu. yds. had accumulated. At odd times, when the derrick crew was not engaged, they broke up these boulders, which ranged in size from ½ cu. yd. to about 3 cu. yds. With one derrick they had to take them out of the pile and place them for breaking with another. After breaking up the stone, they had to keep the pieces cleared out of their way. This is all included in the cost of the work. The aggregate time used in breaking up these 200 cu. yds. was 30 hours, which meant a cost of $30 and a cost per cu. yd. of 15 cents. Considering the material to be broken and the fact that this did not interfere with the other men working in or about the quarry, as blasting would, the cost is quite reasonable.

Five examples of single stones will now be given, they too being granite. This cost does not include cleaning away the pieces, nor bringing the stones to the derrick. It is only the actual cost of breaking.

First Example.—A 1¼ cu. yd. boulder was broken in 4 minutes. Cost 6 2/3 cents or 5⅓ cents per cu. yd.

Second Example.—A 1 cu. yd. boulder was broken in 5 minutes. The stone had to be lifted by the derrick and turned so as to bring the rift to the top. Cost 8⅓ cents.

Third Example.—A 2⅛ cu. yd. boulder was hit twice and broken in 6 minutes. Cost 10 cents or 4.7 cents per cu. yd.

Fourth Example.—A 3 1/3 cu. yd. boulder had to be hit 3 times before it broke, then it went into three pieces. Each of these had to be broken. Thus the weight was hoisted 6 times. Cost 30 cents or 9 cents per cu yd.

Fifth Example.—A 1¾ cu. yd. boulder was not raised by derrick, but was turned over with a pair of grabs. Broken in 5 minutes. Cost 8⅓ cents or 4.8 cents per cu. yd.

For the five boulders, this makes an average cost of 5⅓ cents per cu. yd. From this it is seen that in breaking up the 200 cu. yds. about two-thirds of the cost of the 15 cents was for handling the boulders, clearing away the pieces and some little sledging that may have been done by the crew. Breaking boulders is always done easier by placing a flat stone or block of wood under the piece to be broken, thus making a small air space.

Old castings, slag and other materials can also be broken in the same manner.

Supporting the Discharge Pipe of Dredge.

A novel and useful device is being used in dredging the harbor at Gary, Ind., for holding in place the discharge pipe from the suction dredge. The 24-in. pipe line is suspended from a pontoon made of pairs of 24-in. hollow cylinders built of boiler plate. The cylinders are built in lengths varying from 10 to 80 ft., and are water tight. The two cylinders, lying parallel, are fastened together by timbers under which the discharge pipe is swung. The pipe is laid with flexible joints at intervals, so that bends can be made in it. The sand is being pumped from a thousand to three thousand feet from the dredge.

Double tracking of the mountain district of the Great Northern Ry. will be started in the near future.

The Cost of Rock Drilling in Swedish Mines, Using Electric Drills, Plug Drills and Air Drills.

The following article on rock drilling in Swedish mines is copied from the Proceedings of the Institution of Civil Engineers, having been taken from "Teknish Tidskirft," of Stockholm, Sweden:

"The use of boring machines, which was at first confined to rising in the back of levels, has during the past ten years been extended to cutting plat, shaft sinking and driving the ends. They have shown their advantages, even at a higher price per unit of depth of hole bored. In the Lomberg mining district machines weighing 88 to 110 lbs., with piston of 2 in. diameter, have bored 24.67 ft. per shift of 8 hours, yielding 4.34 tons of rock per metre bored, against 3.45 tons with hand boring (1.32 against 1.05 ton per foot), notwithstanding that the effect of the explosive was diminished from 15.9 tons per kilogram to 10.83 tons (7.21 to 9.49 tons per lb.). The cost per ton of spoil was 10.4 cts., including miners' and fitters' wages, sharpening drills, repairs and power, but nothing for redemption. Hand boring cost only 10 cts. per ton, but the machine did the work of more men. In the same district the cost of driving levels of 43 sq. ft. area has been $3.75 per lineal foot by machine boring, including the same items as above, as against $4.08 by hand; or say, for levels 6 ft. wide by 6 ft. high, $3.20 per ft. forward by machine, against $3.44 by hand. Here the chief gain is that the ends are driven more than twice as fast by machine.

"Pneumatic drills are at present maintaining their superiority over electric, which only under exceptional circumstances can compete with them. At Gräugesberg the author's experience has been that although electric drills take less power, they are not cheaper in working, because what is gained in power is lost in diminished efficiency, and in greater wear and tear. With electric drills the depth bored per core (shift?) has run up to 22.31 ft. in ore and 19.39 ft. in country, with an average depth of 8.53 ft. per hole. With pneumatic drills the corresponding figures have been 32.15 ft. and 25.65 ft or roundly 8.2 ft. more per core (shift?) with the advantage of better ventilation underground.

"In the Rand and Ingersoll machines the piston and drill are in one piece, so that they move together. For some years trials have been made, at Gräugesberg and several other mines in Sweden of an American water jet machine (probably the Leyner drill), in which the piston is separate from the drill and strikes it with great rapidity. Water is ejected by compressed air through the drill hole, and as the drill always strikes on a clean surface, the effect is considerably increased, while the difficulty with the dust is obviated. At Gräugesberg this machine has bored 9,648 ft. in 290 cores (shifts ?) or 33.3 ft. per core, where the Rand machine did no more than 25.82 ft. But the difficulty is to get the steel to stand; the American drills were useless in the hard stone of the Swedish mines. The Storfers Works have now succeeded in making a thoroughly good drill steel.

"The bore holes can be drilled by machine both deeper and larger than by hand with augmented effect. In open quarrying at Gräugesberg the quantity of stone loosened per metre (3.28 ft.) bored has been increased from 4.57 to 1.2 tons (1.39 to 3.41 tons per ft.), and in hard compact rock to 18.7 tons (5.7 tons per ft.), with holes averaging 9.25 ft. deep and 1 in. diameter at bottom. At Kiruna, where the holes are bored twice as deep and 1.6 in. in diameter, the quantity per metre (3.28 ft.) bored has average in three months 102.3 tons (31.2 tons per ft.) and in some places has gone up to 180 tons (55 tons per ft.)

"With the larger and more effective bore holes the rock is blasted in large blocks, which have then to be drilled and blasted smaller for removal. For this purpose portable mechanical jumpers—pneumatic percussion drills held in the hand and requiring no stand—have been devised during 1905 by the Ingersoll firm and by the Atlas Co., Stockholm, both of which have been tried at Gräugesberg on four different kinds of rock. The average work per hour for the Atlas was 80 ins. against 50 ins. with the other. The consumption of compressed air is large; the cost for driving the Atlas runs up to about 4 cts. per foot of hole bored. The author considers that hand boring ought speedily to disappear from mines equipped with compressed air."

[An American is struck by the fact that none of the drills above mentioned appears to have done a fair day's work. This may be due to inefficiency of the men, or to the fact that the rock was unusually tough.—Editor.]

The value of sewer pipe made in the United States in 1906 amounted to $11,114,967, as against $10,097,089 in 1905. Ohio was the largest single producer, the value of its product being $3,987,360. Missouri came next, making sewer pipe valued at $1,208,236.

Draintile to the value of $6,543,289 was manufactured in the United States in 1906. The value of draintile made in 1905 was $15,850,210. The State of Iowa was the largest single producer, the value of its product being $1,721,614.

In building the railroads on the isle of Cebu in the Philippines, an army of the natives are kept at work, being hired directly by the construction company on the graduation. They are moving monthly about 110,000 cu. yds., an average of 30,000 cu. yds. being rock. Picks and shovels, with wheelbarrows for hauling, are used exclusively, and the material is being excavated and transported for 12½ cts. per cu. yd.

Unclassified and General Articles

NOTE: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

The Cost of Five Frame Section Houses

In our issue of August 28 we gave the detailed cost of four frame station buildings. In this issue we continue the series of articles on the cost of railway structures by giving the cost of five frame section houses. These were built in the northwest and were three room houses of very cheap construction, the type known in that section as "Jap houses." The work was done by company forces, the wages being given. As is customary for day labor work, nothing has been allowed for superintendence and general office expenses, as would have been the case if the houses had been built by contract. We have tabulated these costs for easy comparison with other buildings.

The three room houses were 16x24 ft., having 384 sq. ft. of room space. The bill of material for each house was as follows:

Bill of Material for 16x24 Section House.

	Ft. B. M.
44 pcs. 2x12—2	176
5 pcs. 6x6—16	240
18 pcs. 2x8—16	384
18 pcs. 2x4—16	192
36 pcs. 2x4—12	288
2 pcs. 1x6—14	14
70 pcs. 2x4—8	373
24 pcs. 2x4—14	192
16 pcs. 2x4—16	171
4 pcs. 2x2—12	16
1,940 ft. com. boards, s1s	1,940
95 pcs. 1x10—10, s1s	792
1 pc. 2x12—12, s1s	24
6 pcs. 1x6—14, s1s	42
4 pcs. 1x12—14, s1s	56
8 pcs. 1x6—12, s1s	48
1,700 ft. 1x6 D. and M., s1s	1,700
270 ft. 1x6 D. and M., s2s	270
95 pcs. 1x3—10	237
7 pcs. 2x4—12, s4s	56
11¾x¾x12, ¼ rd	132
2 pcs. 2x4—14, s4s	19
4 pcs. 4x4—6	32

5 M. shingles.
15 pcs. ⅞x1¾—16 cover moulding.
18 pcs. 8x10 flashing tin.
1 door 2.10x6.10x1⅛, 4 P. and G.
1 door frame, as above.
2 doors 2.8x6.8x1⅛, 4 P. and G.
4 windows 10x16—1⅜. 12 lts.
4 window frames.
350 brick.
10 lbs. 20d nails.
100 lbs. 8d nails.
25 lbs. shingle nails.
10 sash spring bolts.
3 prs. wrought butts.
3 doz. 1-in. No. 8 screws.
1 sack lime.
2 rolls tarred paper.
3 rim locks and knobs complete.
5 gals. outside body paint.
1 gal. outside trimming paint.
5 gals. inside body paint.
1 gal. inside trimming paint.

The estimated weight is:

	Pounds.
7,200 ft. B. M. at 3,300 lbs	23,760
5 M. shingles at 150 lbs	750
Mill work	500
Hardware and paint	400
Brick	2,100
Total	27,510

For practical purposes the weight can be considered as 14 tons.

The cost of materials and labor for each house was:

House No. 1:

Lumber:	
2,045 ft. B. M., $7.50	$15.35
2,902 ft. B. M., s1s, $8	23.22
2,207 ft. B. M., 1x6, D. and M., $12	26.48
100 ft. B. M., $9	.90
7,255 ft. B. M., total, $9.10 (av.)	$65.95
5 M. shingles, Star S, $1.35	$6.75
Millwork:	
Moulding	$ 2.50
3 doors and 4 windows	26.46
Total	$28.96
Hardware:	
2 rolls tarred paper, 85 cts	$ 1.70
135 lbs. nails	4.94
Locks, hinges, etc	4.82
18 pcs. 8x10 flashing tin	.48
Total	$11.94
Paint:	
5 gals. o. s. body paint at 75 cts	$3.75
1 gal. o. s. trimmings at 70 cts	.70
5 gals. i. s. body paint at 80 cts	4.00
½ gal. i. s. trimmings at 85 cts	.43
Total	$8.88
Masonry:	
350 brick at $7.50	$2.62
Labor:	
Engineering	$4.05
Building section house:	
16.5 days, carpenter, at $2.50	$41.25
2.0 days, bridgeman, at $2.25	4.50
18.5 days, total, at $2.47	$45.75
Building flue:	
1 day, bridgeman, at $2.25	$2.25
1 day, helper, at $1.75	1.75
	$4.00
Painting:	
4 days, foreman, at $2.50	$10.00
Tools	$4.50

SUMMARY.

Materials:	Totals.	Pct.
7,255 ft. B. M. lumber at $9.10	$ 65.95	29.0
5 M. shingles at $1.35	6.75	2.9
Millwork	28.96	12.8
Hardware	11.94	5.2
Paint	8.88	3.9
Masonry, 350 brick, $7.50	2.62	1.1
Total materials	$125.10	54.9
Labor:		
Engineering	$4.05	1.8
18.5 days building house, $2.47	45.75	20.1
2 days building flue, $2	4.00	1.8
4 days painting, $2.50	10.00	4.4
Total labor	$63.80	28.1
Total material and labor	$188.90	83.0
Tools	4.50	2.0
Freight, 14 tons (excess. chg.)	33.44	15.0
Total	$226.84	100.0
	Per Sq. Ft.	Per Cent.
Materials	$0.326	55.2
Labor	0.167	28.3
Tools	0.012	2.0
Freight	0.085	14.5
Total	$0.590	100.0

House No. 2:

Labor:	
Unloading material:	
2 days, carpenter, at $2.50	$ 5.00
Building house:	
16.5 days, carpenter, at $2.50	41.25
Building flue:	
1.3 days, mason, at $3	3.90
Painting:	
1 day, foreman, at $2.50	2.50
3 days, helper, at $1.75	5.25
Total labor	$ 7.75
Tools	$3.65

SUMMARY.

Materials:	Total.	Pct.
7,255 ft. B. M. lumber at $9.10	$ 65.95	30.9
5 M. shingles at $1.35	6.75	3.1
Millwork	28.96	13.5
Hardware	11.94	5.6
Paint	8.88	4.1
Masonry, 350 brick, $7.50	2.62	1.2
Total materials	$125.10	58.4
Labor:		
18.5 da., build'g house, at $2.50	$46.25	21.7
1.3 days, building flue, at $3	3.90	1.8
Painting	7.75	3.6
Total labor	$57.80	27.1
		Pct.
Total material and labor	$182.90	85.5
Tools	3.65	1.7
Freight	27.31	12.8
Total	$213.86	100.0
	Per Sq. Ft.	Per Cent.
Materials	$0.326	58.7
Labor	0.150	27.1
Tools	0.009	1.6
Freight	0.071	12.6
Total	$0.556	100.0

House No. 3:

Labor:	
Unloading materials:	
2 days, carpenter, at $2.50	$5.00
Building house:	
16 days, carpenter, at $2.50	$40.00
Cleaning up old material:	
1 day, carpenter, at $2.50	$2.50
Painting:	
1 day, foreman, at $2.50	$2.50
4 days, helper, at $1.75	7.00
Total labor	$9.50
Tools	$4.18

SUMMARY.

Materials:	Total.	Pct.
7,255 ft. B. M. lumber, at $9.10	$ 65.95	33.1
5 M. shingles at $1.35	6.75	3.3
Millwork	28.95	14.6
Hardware	11.94	6.0
Paint	8.86	4.4
Masonry, 350 bricks, at $7.50	2.62	1.3
Total materials	$125.10	62.7
Labor:		
19 days building house at $2.50	$47.50	23.7

Painting	9.50	4.7
Total labor	$57.00	28.4

		Pct.
Total materials and labor	$182.10	91.1
Tools	4.18	2.0
Freight	13.79	6.9
Total	$200.07	100.0

	Per Sq. Ft.	Per Cent.
Materials	$0.326	62.7
Labor	0.148	28.4
Tools	0.010	1.9
Freight	0.036	7.0
	$0.520	100.0

House No. 4:

Labor:

Building house:	
16.6 days, carpenter, at $2.50	$41.50
Building flue:	
1 day, carpenter, at $2.50	$2.50
1 day, helper, at $1.75	1.75
	$4.25
Painting:	
3 days, foreman, at $2.50	$7.50
2 days, helper, at $1.75	3.50
Total labor	$11.00
Tools	$3.82

SUMMARY.

Materials:

	Total.	Pct.
7,255 ft. B. M. lumber at $9.10	$65.95	33.6
5 M. shingles at $1.35	6.75	3.3
Millwork	28.96	14.7
Hardware	11.94	6.1
Paint	8.86	4.5
Masonry, 350 brick, $7.50	2.62	1.3
Total materials	$125.10	63.5
Labor:		
16.6 days build'g house at $2.50	$41.50	21.1
Building flue	4.25	2.2
Painting	11.00	5.6
Total labor	$56.75	28.9

		Pct.
Total materials and labor	$181.85	92.4
Tools	3.82	2.0
Freight	10.67	5.4
Total	$196.34	100.0

	Per Sq. Ft.	Per Cent.
Material	$0.326	63.4
Labor	0.150	29.2
Tools	0.010	2.0
Freight	0.028	5.4
	$0.514	100.0

House No. 5:

Labor:

Unloading materials:	
1 day, carpenter, at $2.50	$2.50
Building house:	
20 days, carpenter, at $2.50	$50.00
Building flue:	
3 days, carpenter, at $2.50	$7.50
Painting:	
5 days, foeman, at $2.50	$12.50
1 day, helper, at $1.75	1.75
Total labor	$14.25
Tools	$4.44

SUMMARY.

Materials:

	Total.	Pct.
7,255 ft. B. M. lumber at $9.10	$65.95	32.2
5 M. shingles at $1.35	6.75	3.2
Millwork	28.96	14.0
Hardware	11.94	5.8
Paint	8.86	4.3
Masonry, 350 bricks, $7.50	2.62	1.3
Total materials	$125.10	60.8
Labor:		
21 days building house at $2.50	$52.50	25.4
Building flue	7.50	3.6
Painting	14.25	7.0
Total labor	$74.25	36.0

		Pct.
Total material and labor	$199.35	96.8
Tools	4.44	2.0
Freight	2.51	1.2
Total	$206.30	100.0

	Per Sq. Ft.	Pct.
Materials	$0.326	60.6
Labor	0.193	36.0
Tools	0.012	2.1
Freight	0.007	1.3
	$0.538	100.0

A comparison of the costs of these buildings with those in our issue of Aug. 28 brings out some interesting facts, and may serve as a basis for making future estimates on work of this character. It must be borne in mind that the cost of lumber is extremely low, even for the section in which this particular building work was done.

For the station buildings the average cost per square foot of floor space was:

	Per Sq. Ft.
Materials	$0.397
Labor	0.378
Tools	0.026
Freight	0.051
	$0.852

For the section houses the same cost was:

	Per Sq. Ft.
Materials	$0.326
Labor	0.160
Tools	0.010
Freight	0.045
	$0.541

The average per cent of cost on the station buildings is as follows:

	Per Cent.
Materials	45
Labor	47
Tools	3
Freight	5
	100

That for the section houses it is:

	Per Cent.
Materials	60
Labor	30
Tools	2
Freight	8
	100

It can be seen that the items of tools and freight on both classes of buildings amount to about 10 per cent. On the cheaper buildings the materials cost more than the labor, while with the more expensive buildings these two costs are about equal.

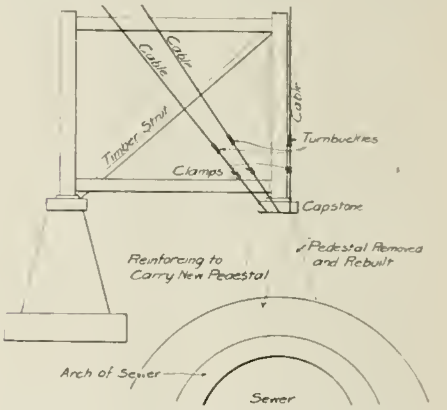
Since the weight of the buildings is given in all cases, it is easy to calculate the freight for any given haul.

The average cost of the labor on these section houses was $62 per section house. There were 7,250 ft. B. M. in each section house, and, if we charge the full cost of the labor ($62) against this amount of lumber, we have a trifle less than $9 per 1,000 ft. B. M.

Holding a Trestle Leg Up, While Working Beneath It.

In a paper by Mr. W. C. Parmley, in the Transactions of the American Society of Civil Engineers, describing the construction of the Walworth sewer, is given a description of the method used by the contractors, Bramley & Gribben, of Cleveland, O., in holding up one leg of a viaduct, the masonry under which came directly in the new sewer. The viaduct carried street traffic. We quote as follows:

"Where the sewer passed under the Abbey Street viaduct, it was somewhat of a problem to carry the weight of one of the trestle columns during the construction of the sewer. The contractor solved the problem in his own way, and very satisfactorily. Traffic on the viaduct was not interrupted except by erecting barriers so as to deflect the traffic to the other side of the roadway where the weight would be carried directly to the undisturbed foundations. The post which rested upon the pier to be removed was suspended by passing a cable from the foot of the post diagonally upward to the top of the opposite post, and other cables to the tops of both posts composing the next pair of the trestle bents. By means of turn-buckles, the weight of the columns and the capstone of the pedestal attached was lifted free from the pedestal. Timber struts were also put in along with the cables in order to take up vibration. The arrangement of cable and struts is shown in Fig. 1. The construction of the sewer was carried forward as near as practicable to the pier to be removed, and the excavation and the foundations at the sides were carried forward a short distance on either side and beyond the pedestal. The pedestal was then removed, leaving the capstone hanging to the foot of the viaduct column, and the sewer structure was carried through to completion without interference underneath. After the arch had been completed, the upper portion of the pedestal was rebuilt upon the back of the arch, and, after the arch had sufficiently hardened, the turnbuckles were gradually loosened and the weight brought to bear upon the new structure."



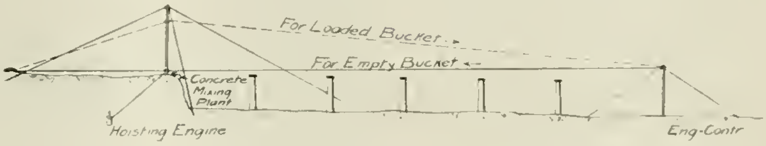
Method of Supporting Leg of Viaduct While Sewer Was Built Under It.

Methods and Costs; Some Old, Some New.

Pumping by Electricity.—The Calder & Hebble Navigation Co. (England) in making some repairs to a lock found it necessary to temporarily draw away the water from that portion of the canal. Accordingly at a little distance from each end of the lock a dam was constructed, and at the east end a platform was erected over the canal. At this platform a centrifugal pump was placed together with a 25 H. P. motor driven by electrical energy supplied from the mains of a local power company, which also loaned the motor. The motor occupied a space of about 2 ft. by 2½ ft. and water was pumped at the rate of about 145,000 gallons per hour.

Driving Sheet Piling With Rock Drill.—A No. 4 Ingersoll-Sergeant steam drill with the rotating device removed and the drill replaced by a square steel bar was used in driving some sheet piling. The lower end of the drill was enclosed by a flat steel bar bent to form a rectangular frame and bolted to the drill. A rectangular hole through the flat end of this frame engaged a corresponding projection formed by a steel anvil block riveted to the upper side of the driving cap. This cap was formed by bending a thick steel bar to a U-shape. A pair of handles were also bolted to opposite sides of the drill. The hammer while in operation was supported by a rope suspended from overhead supports. It was raised and lowered by a four-part hand tackle and required a vertical clearance of about 9 ft. for effective work. In operating the hammer two men on top guided it by the handles and a third man adjusted the U-shape pile cap. The cost of changing the rock dril to a hammer was about $15, and the results obtained were very satisfactory, it being found that the pile was forced down at the rate of about 1 in. per minute when the point was 4 or 5 ft. below the surface. The efficiency of the hammer might possibly have been promoted by increasing its weight 50 or 100 lbs.

Grouting a Bridge Pier.—A 30 ft. long, 16½ ft. wide pier having rounded ends, had its upper part displaced by an accident. On investigation it was found that a large crack, practically horizontal in direction, had developed at a level about 10 ft. below water. At one end of the river face this crack was about 3 ins. wide, while at the opposite face it was 5 ins. In addition near this latter end of the face and 12 ins. and 30 ins. above the main crack were two other parallel cracks 4 in. and 6 in. wide. The intervening masonry was also badly broken up. The main crack extended to a point a little beyond the middle of the rounded ends of the pier, and near one end it slanted downward to a level about 5 ft. lower. It was decided to leave the pier in its new position, merely changing the bridge bearings to correct elevation and alignment, and to restore the strength and continuity of the masonry by injecting cement grout into the cracks; this latter was done in the following manner: The crack was first closed off very carefully with wooden wedges and oakum placed by divers. In addition a strip of canvas, 5 ft. wide, stiffened with vertical studs 10 ins. apart, was laid around the cracked portion of the pier and tied down by chains and by steel hoops at the top and bottom. Sections of 1½ in. pipe were fitted into the packing and at nine points passed into the crack, vertical risers going above the water level being connected to these pipes by elbows. The grouting apparatus was assembled on two scows. It consisted of a compressor, delivering air at 120 lbs. to 150 lbs. per square inch; a receiver of 10 cu. ft. capacity, fitted with a controllable reducing valve on the discharge valves. Three grouting drums of 2½ cu. ft. capacity each were used. These drums had their inlets connected by hose with the receiver discharge, and each were fitted with a stirrer which was operated by hand. The grouting hose was so arranged that it could be attached to any one of the three discharge pipes. The mortar (1 to 1 mixture) was mixed dry on shore and carried to the scows and there mixed in barrels with an equal volume of water and poured into the drums. A pressure up to 60 lbs. per square inch was used in grouting, the several pipes being taken in order, beginning with the one nearest the lowest portion of the crack. The grouting was carried on continuously for 13½ hours, when it was found that all the riser pipes contained grout. In all 495 cu. ft. of grout was injected. As there was some doubt as to the time to allow for the setting of the grout, two canvas-lined boxes were filled with grout on the day the work was done and lowered into the water alongside the pier. Samples were taken from these boxes after two and four weeks and tested. Occasional drilling tests were also made on the cement at the face of the crack, and five weeks after the grouting had been completed a load test of the pier was made. The total cost of the grouting and calking operations was about $2,200.



Gravity Cableway.

Gravity Cableway.—We illustrate herewith a cableway which was used in the construction of concrete piers for a bridge over a river. The river was about 800 ft. wide, about 3 ft. deep, and had banks about 20 ft. high. The piers were about 21 ft. high. The towers for the cableway consisted of a 55 ft. derrick without boom, placed near the bank on the center line of the piers and well guyed and a two-leg bent placed in the middle of the river and held in place by four cable guys anchored to the river bottom. A ¾ in. steel hoisting cable was stretched from a deadman on shore, about 150 ft. back of the derrick, and followed along the center line of the piers, past the derrick just clearing it, to the bent in the middle of the river. At the top of this bent was a 16 in. cable block. Through this block the cable passed down and was made fast to a weight, consisting of a skip loaded with concrete until the cable had the required tension, and a pitch of 18 to 20 ft. from center of river to anchor on shore. In order to secure the required pitch from the shore to the river bent the boom fall of the derrick was hooked onto the cable at the foot of the mast, and then, by going ahead on the single drum hoisting engine, was raised to the mast head. This gave the cable a pitch of 18 to 20 ft. from mast head to top of bent in river. The carriage used on the cableway consisted of two 16 in. cable sheaves with iron straps, forming a triangle, with a chain hanging from the bottom point, to which was attached the 5 cu. ft. capacity concrete bucket. The concrete was mixed on a platform at the foot of the mast. When ready for operation the chain on the carrier was hooked to the bucket of concrete, the engine started, and both bucket and cable raised, the former running by gravity to the pier. The speed of descent was governed by the height to which the cable was raised on the derrick, and as the bucket neared the dumping point the engine was slacked off and the cable leveled. The bucket was dumped by a man on a staging erected on the pier form. For the return of the bucket the engine was slacked off and the weight on the river bent would pull the cable tight so that the pitch would be toward the shore and the bucket could run down the grade to the mixing platform, the speed being governed as before by leveling the cable. When the piers were completed to the middle of the river the engine and derrick were taken over to opposite side of the river, the bent being left in the middle, and the work continued. By using the extreme grade of the cable it was found that the bucket would run from the platform to the bent (400 ft.) in less than 35 seconds.

A Notable Example of Coppersmith Work.

As an example of heavy copper pipe work the accompanying illustration is particularly interesting as the pipes shown are of very unusual weight and sizes. The two copper pipes seen in the illustration are the main exhaust pipes of the Curtis turbine steamship "Creole" and were made at the copper shop of the Fore River Shipbuilding Co., at Quincy, Mass., the builders of the vessel. Each of these pipes weighs 2,500 lbs. Each pipe is 42 in. in diameter, inside measurement, and 5/16 in. in thickness. Each pipe was made from sheet copper in four pieces and the skill used in brazing these pipes together is clearly shown in the smoothness and shapeliness of the pipes, the workmanship on which will quickly appeal to all coppersmiths, who will appreciate that the pipe is nearly, if not quite, the largest size copper pipe made in this country for marine purposes.

Sheet Copper Pipe 42 ins. in Diamter for Steamship Creole.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0335. **Refrigerating Machinery.**—United States Automatic Ice Machine Company, Dayton, Ohio.

This pamphlet describes the construction and advantages of the Hiester Automatic Ice Making and Refrigerating Machinery built by the company named. It is stated that this class of machinery is new in its application, and also that new principles are involved in the automatic features. The machinery is especially adapted for small packing houses, ice plants, etc. Illustrations and descriptions of the several machines are given, and there are also drawings showing complete refrigerating plants.

No. 0336. **Oil and Gasoline Pump.**—The National Oil Pump and Tank Co., Dayton, Ohio.

This pamphlet describes in detail a pump for handling oil and gasoline in factories, automobile garages and similar places. The pump is a combination suction and force pump registered to tally the exact amount of fluid handled. The descriptive text of the catalog is very complete and there are a number of illustrations showing typical installations of the pump and the accessory tanks. The company also handles a number of other devices for filtering and pumping oil and gasoline.

No. 0337. **Refrigerating Machinery.**—De la Vergne Machine Co., New York.

This pamphlet illustrates some of the various types of refrigerating and ice making machines built by the company named. The descriptive text is very brief. As many of our readers doubtless know, this company builds machines ranging from those having a cooling capacity equivalent to the melting of five tons of ice per day up to those having a cooling capacity equivalent to the melting of 500 tons of ice per day. The pamphlet is interesting as containing a brief historical sketch of the De La Vergne double acting compression machine.

No. 0338. **Feed Water Heater and Purifier.**—Wickes Bros., Saginaw, Mich.

This circular describes briefly the Wickes open exhaust steam feed water heater and purifier, and states its advantages for engine room purposes.

No. 0339. **Cost of Irrigation.**—American Well Works, Aurora, Ill.

This pamphlet contains an interesting discussion on the comparative first cost of operating pumping plants. Gasoline and steam driven plants are discussed, and cost of irrigating with pumps, quantity of water required, waste of power by using small pipe, etc., are all considered. The discussion is an argument for the use of the American Centrifugal Pump built by the company issuing the pamphlet.

No. 0340. **Special Castings for Water Works.**—Builders' Iron Foundry, Providence, R. I.

This is a catalog giving dimensions and prices of all sorts of special castings for water works. The specials include bends, elbows, offsets, sleeves, plugs, caps, gate boxes and a great variety of combination castings. The pamphlet also describes briefly the Venturi meter and gives tables of velocity of the discharge of water through cast iron pipe and other tables of useful information for the water works superintendent.

No. 0341. **Grinding Machinery.**—Norton Grinding Co., Worcester, Mass.

This pamphlet is devoted entirely to a description and illustrations of the plain cylindrical grinding machines made by the company named. The special advantages of fixed wheel base, moving work table, speed changing devices, etc., are all described and discussed in detail. Each machine is illustrated and given a separate description which includes all the essential features about which the purchaser is likely to desire information. Some of the machines illustrated are of very large size.

No. 0342. **Electrical Machinery.**—General Electric Co., Schenectady, N. Y.

The three bulletins reviewed here describe and illustrate the company's system of electric train lighting, cylinder controllers and the Thompson inclined coil portable indicating instrument. The bulletin on electric train lighting is quite fully illustrated and gives a very clear idea of the company's system.

No. 0343. **Concrete Mixer.**—Burrell Mfg. Co., Bradley, Ill.

This pamphlet illustrates and describes briefly the construction and operation of the Burrell Hand Power Concrete Mixer. The mixer is a light machine and is particularly adapted for the use of concrete block manufacturers.

No. 0344. **Engineers' Hand Book of Concrete Reinforcement.** American Steel and Wire Co., Chicago, Ill.

This volume is an attempt to present a hand book of concrete reinforcement something after the style of the hand books published by various steel works, such as the Carnegie and Pencoyd. The first part of the pamphlet, which contains something over a hundred pages, is devoted to a discussion of concrete and reinforced concrete work. The text consists very largely of reprints of papers that have been published in the technical journals, and of chapters from well known treatises on concrete and reinforced concrete construction. Naturally there is contained in this reprint matter a large amount of useful information for the concrete engineer. Following this text portion of the book, there is a very complete series of tables of weights, areas and sizes of triangular and square mesh reinforcement made by the company named. There are also tables and diagrams of bending moment and a number of illustrations showing typical floor and roof slab constructions. The pamphlet closes with a series of half tone illustrations showing buildings in which the wire mesh reinforcement manufactured by this company has been used.

No. 0345. **Sewer Pipe.**—Patton Clay Mfg. Co., Patton, Pa.

This pamphlet, which has been very handsomely gotten up, is chiefly a price list of the various sizes of sewer pipe and special burnt clay products manufactured by the company named. Besides sewer pipe the company manufactures wall copings, chimney tops, flue pipe and building blocks and ornamental terra cotta work. The pamphlet is of convenient size to carry and is well worth having for the convenient information which it contains relating to sewer pipe and burnt clay articles used by the engineer and builder.

Personals.

Mr. L. J. Wagner has been appointed Superintendent of Streets and Water Works of Rome, Ga.

Mr. H. S. Jones, heretofore General Superintendent of the Mobile, Jackson & Kansas City R. R., has been appointed Chief Engineer, and the former position has been abolished

Mr. Charles J. Steffens, secretary and manager of the Guarantee Construction Co. of New York City, and Miss Blanch O. Conover of Port Jefferson, N. Y., were married Sept. 4.

Messrs. Wm. C. Pickersgill, Edgar F. Smith, Herbert M. Hale and Ralph H. Stearns have been appointed to the position of Assistant Engineer, Designer, Board of Water Supply of New York City.

Mr. C. C. Stroufe, formerly Constructing Engineer for the Randolph lines in Sonora, Mexico, has been appointed Assistant to the Chief Engineer of the Oregon Short Lines R. R., with headquarters at Portland, Ore.

Mr. L. A. Waterbury has been appointed Professor of Civil Engineering at the University of Arizona. For the past four years Mr. Waterbury has been instructor in civil engineering at the University of Illinois.

Mr. Arthur E. Loder has been appointed Chief Engineer of the Highway Commission of Los Angeles county, Cal. Mr. Loder was formerly First Assistant Engineer in the Office of Public Roads, U. S. Department of Agriculture.

Mr. J. W. Buzzell has resigned as general manager for Frank B. Gilbreth, contractor, of New York City, and has accepted a corresponding position with the Consolidated Engineering and Construction Co., Metropolitan Life Bldg., New York City.

Mr. E. W. Cunningham has resigned his position as Erecting Superintendent for the Pittsburg Filter Mfg. Co., and has accepted a position with Bowman Bros., contractors, who have the contract for the construction of the new filtration plant at McKeesport, Pa.

Mr. Richard J. McGrann, a prominent railroad contractor, died Sept. [illegible] at his home in Lancaster, Pa. Mr. McGrann was 70 years old, just the age of his cousin, Bernard J. McGrann, whose death on Aug. 28 was mentioned in this column last week. Mr. McGrann began railroad contracting when a young man, among his contracts being work on the Downingtown & Waynesboro R. R., the New Castle & Beaver Valley R. R., and "the Buck road" through the Wyoming Valley. In 1862-3 he built the Chestnut St. bridge, Philadelphia. In recent years he built 40 miles of road in the Shenandoah Valley, and had large contracts with the Norfolk & Western and Louisville & Nashville railroads. He connected the Lynchburg & Durham with the Norfolk & Western and made the Cripple Creek and Pocahontas extensions.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Sept. 11.	Philadelphia, Pa.	Sept. 4
Sept. 13.	Lorain, O.	Sept. 4
Sept. 13.	Dunbar, Neb.	Sept. 4
Sept. 14.	Cleveland, O.	Aug. 28
Sept. 16.	Adin, Cal.	Aug. 28
Sept. 16.	Madera, Cal.	Aug. 14
Sept. 16.	Sherman, Tex.	Sept. 11
Sept. 16.	Albany, N. Y.	Sept. 11
Sept. 16.	Minneapolis, Minn.	Sept. 11
Sept. 18.	Houston, Texes	Sept. 4
Sept. 18.	Fort Wayne, Ind.	Sept. 11
Sept. 18.	Fort Wayne, Ind.	Sept. 11
Sept. 20.	Cincinnati, O.	Sept. 11
Sept. 20.	Greeley, Colo.	Sept. 11
Sept. 23.	Newark, O.	Sept. 4
Sept. 27.	Denver, Colo.	Sept. 11
Sept. 30.	Oakland, Cal.	Sept. 11
Sept. 31.	Guthrie, Okla.	Sept. 4
Sept. 30.	Santiago, Chile	July 17
Oct. 7.	Salem, Ind.	Sept. 11
Oct. 14.	Los Angeles, Cal.	Sept. 11
Oct. 15.	Dunrea, Man.	Sept. 4
Oct. 19.	Canton, China	Sept. 4

Buildings.

Sept. 11.	Eureka, Cal.	Aug. 14
Sept. 11.	New York, N. Y.	Sept. 4
Sept. 12.	Marianna, Fla.	Aug. 28
Sept. 12.	Rome, N. Y.	Aug. 28
Sept. 12.	Fort Sam Houston, Tex.	Sept. 4
Sept. 12.	Des Moines, Ia.	Sept. 11
Sept. 13.	Park Rapids, Minn.	Sept. 4
Sept. 13.	Chicago, Ill.	Sept. 4
Sept. 13.	Kansas City, Mo.	Sept. 11
Sept. 14.	Hudson, N. Y.	Aug. 28
Sept. 14.	Washington, D. C.	Sept. 4
Sept. 14.	Chauncey, O.	Sept. 11
Sept. 14.	Cape May, N. J.	Sept. 11
Sept. 14.	Decatur, Ind.	Sept. 11
Sept. 14.	Childersburg, Ala.	Sept. 11
Sept. 14.	Washington, D. C.	Sept. 11
Sept. 15.	Owensville, Ind.	Sept. 4
Sept. 15.	Oxly, Mo.	Sept. 11
Sept. 16.	Washington, D. C.	Aug. 28
Sept. 16.	Pittsburg, Pa.	Aug. 7
Sept. 16.	Buffalo, N. Y.	Aug. 7
Sept. 16.	Pullman, Wash.	Sept. 4
Sept. 16.	Fort Wayne, Va.	Sept. 11
Sept. 16.	Scotland, Pa.	Sept. 11
Sept. 16.	Albany, N. Y.	Sept. 11
Sept. 17.	Lawrence, Kans.	Aug. 28
Sept. 17.	San Francisco, Cal.	Aug. 14
Sept. 17.	Montclair Heights, N. J.	Sept. 11
Sept. 17.	Washington, D. C.	Sept. 11
Sept. 17.	Soldiers' Home, Cal.	Sept. 11
Sept. 17.	Kankakee, Ill.	Sept. 11
Sept. 18.	Chicago, Ill.	Sept. 11
Sept. 18.	Cincinnati, O.	Sept. 11
Sept. 18.	Edgewater, N. J.	Sept. 11
Sept. 18.	Delavan, Wis.	Sept. 11
Sept. 18.	Agricultural College, Mich.	Sept. 11
Sept. 19.	Muscatine, Ia.	Aug. 14
Sept. 19.	Chicago, Ill.	Sept. 11
Sept. 20.	Chicago, Ill.	Sept. 11
Sept. 23.	Cedar Rapids, Ia.	Aug. 14
Sept. 23.	Washington, D. C.	Sept. 11
Sept. 24.	Hamilton, O.	Aug. 21
Sept. 24.	Danville, Pa.	Sept. 11
Sept. 26.	Muscatine, Ia.	Sept. 11
Sept. 26.	Riverside, Cal.	Sept. 11
Sept. 27.	Hesperus, Cal.	Sept. 11
Sept. 30.	Selma, Ala.	Aug. 28
Sept. 30.	West Point, N. Y.	Sept. 11
Oct. 1.	Eau Claire, Wis.	Aug. 28
Oct. 1.	Pensacola, Fla.	Aug. 21
Oct. 1.	Indianapolis, Ind.	Sept. 4
Oct. 1.	Indianapolis, Ind.	Sept. 4
Oct. 3.	Bayonne, N. J.	Sept. 11
Oct. 5.	New Orleans, La.	Sept. 11
Oct. 7.	Baltimore, Md.	Aug. 28
Oct. 14.	San Diego, Cal.	Sept. 11
Oct. 17.	Peoria, Ill.	Sept. 11
Oct. 21.	Des Moines, Ia.	Sept. 11

Roads and Streets.

Sept. 11.	Bridgeton, N. J.	Aug. 28
Sept. 11.	Cincinnati, O.	Aug. 28
Sept. 11.	Cleveland, O.	Aug. 21
Sept. 11.	Cleveland, O.	Aug. 21
Sept. 12.	Cincinnati, O.	Aug. 28
Sept. 12.	Silverton, O.	Sept. 4
Sept. 12.	Marietta, O.	Sept. 4
Sept. 12.	Grand Rapids, Mich.	Sept. 11
Sept. 12.	Decatur, Ind.	Sept. 11
Sept. 12.	Toledo, O.	Sept. 11
Sept. 13.	Des Moines, Ia.	Aug. 28
Sept. 13.	Madison, Wis.	Aug. 28
Sept. 13.	Cincinnati, O.	Sept. 4
Sept. 13.	Chanute, Kan.	Sept. 11
Sept. 13.	Terre Haute, Ind.	Sept. 11
Sept. 13.	Indianapolis, Ind.	Sept. 11
Sept. 13.	Des Moines, Ia.	Sept. 11
Sept. 14.	St. Moultrie, S. C.	Aug. 28
Sept. 14.	Pontiac, Ill.	Sept. 11
Sept. 14.	Cleveland, O.	Sept. 11
Sept. 14.	Milwaukee, Wis.	Sept. 11
Sept. 14.	Peru, Ind.	Sept. 11
Sept. 14.	Fort Moultrie, S. C.	Sept. 11
Sept. 16.	Euclid, O.	Sept. 4
Sept. 16.	St. Paul, Minn.	Sept. 4
Sept. 16.	Weehawken, N. J.	Sept. 11
Sept. 16.	Union, N. J.	Sept. 11
Sept. 16.	Albany, N. Y.	Sept. 11
Sept. 16.	Winona, Minn.	Sept. 11
Sept. 16.	St. Paul, Minn.	Sept. 11
Sept. 16.	Louisville, Ky.	Sept. 11
Sept. 16.	Evansville, Ind.	Sept. 11
Sept. 16.	Des Moines, Ia.	Sept. 11
Sept. 16.	Kansas City, Mo.	Sept. 11
Sept. 16.	Devils Lake, N. Dak.	Sept. 11
Sept. 17.	Kansas City, Mo.	Sept. 11
Sept. 17.	Eveleth, Minn.	Sept. 11
Sept. 17.	Waseca, Minn.	Sept. 11
Sept. 17.	Logansport, Ind.	Sept. 11
Sept. 18.	Cincinnati, O.	Sept. 4
Sept. 18.	Brooklyn, N. Y.	Sept. 11
Sept. 18.	St. Joseph, Mich.	Sept. 11
Sept. 19.	Des Moines, Ia.	Sept. 11
Sept. 19.	Kansas City, Mo.	Sept. 11
Sept. 19.	Fort Wayne, Ind.	Sept. 11
Sept. 19.	Cincinnati, O.	Sept. 11
Sept. 20.	Rockville, Ind.	Aug. 28
Sept. 20.	Frankfort, Ind.	Sept. 4
Sept. 20.	Dallas, Tex.	Sept. 11
Sept. 20.	Buffalo, N. Y.	Sept. 11
Sept. 20.	Frankfort, Ind.	Sept. 11
Sept. 20.	Cincinnati, O.	Sept. 11
Sept. 21.	Silverton, O.	Sept. 11
Sept. 21.	Washington, D. C.	Sept. 11
Sept. 21.	Racine, Wis.	Sept. 11
Sept. 24.	Lebanon, Ind.	Sept. 4
Sept. 24.	Woodcliff Lake, N. J.	Sept. 11
Sept. 26.	Danville, Ill.	Sept. 11
Sept. 28.	Manassas, Va.	Sept. 11
Sept. 28.	Vincennes, Ind.	Sept. 11
Oct. 1.	Billings, Mont.	Sept. 11
Oct. 7.	Salem, Ind.	Sept. 11
Oct. 8.	Vincennes, Ind.	Sept. 11
Oct. 14.	Sunman, Ind.	Sept. 11

Sewers.

Sept. 11.	New Orleans, La.	July 10
Sept. 11.	New York, N. Y.	Sept. 4
Sept. 11.	Hoboken, N. J.	Sept. 4
Sept. 11.	Philadelphia, Pa.	Sept. 4
Sept. 11.	Chicago, Ill.	Sept. 4
Sept. 12.	Winamac, Ind.	Sept. 11
Sept. 12.	Boston, Mass.	Sept. 11
Sept. 13.	Des Moines, Ia.	Aug. 28
Sept. 13.	Lake Mills, Wis.	Aug. 21
Sept. 13.	Dayton, O.	Sept. 11
Sept. 16.	Linton, Ind.	Sept. 4
Sept. 16.	Chattanooga, Tenn.	Sept. 4
Sept. 16.	Canton, O.	Sept. 4
Sept. 16.	Ypsilanti, Mich.	Sept. 11
Sept. 16.	Winona, Minn.	Sept. 11
Sept. 17.	South Orange, N. J.	Sept. 4
Sept. 17.	Summit, N. J.	Sept. 11
Sept. 17.	Philadelphia, Pa.	Sept. 11
Sept. 18.	Oakland, Cal.	Sept. 11
Sept. 19.	Canton, Miss.	Sept. 4
Sept. 19.	Togus, Me.	Sept. 4
Sept. 17.	Brooklyn, N. Y.	Sept. 11
Sept. 18.	Brooklyn, N. Y.	Sept. 11
Sept. 18.	Chicago, Ill.	Sept. 11
Sept. 18.	Chicago, Ill.	Sept. 11
Sept. 19.	Fort Wayne, Ind.	Sept. 17
Sept. 21.	Aurora, Neb.	Sept. 11
Sept. 21.	Hamilton, O.	Sept. 11
Sept. 27.	Delaware, O.	Sept. 11
Sept. 27.	North Chicago, Ill.	Sept. 11
Oct... 1.	Cadillac, Mich.	Sept. 11
Oct. 1.	Paducah, Ky.	Sept. 11
Oct. 3.	Fort Dade, Fla.	Sept. 11

Water Supply.

Sept. 12.	Lindsay, Neb.	Sept. 11
Sept. 13.	Lawrenceburg, Tenn.	Sept. 11
Sept. 14.	Norfolk, Va.	Aug. 21
Sept. 14.	Gregory, S. Dak.	Sept. 11
Sept. 14.	Uhiah, Cal.	Sept. 11
Sept. 16.	Fort H. G. Wright, N. Y.	Sept. 11
Sept. 20.	Canon City, Colo.	Sept. 4
Sept. 21.	Fort Oglethorpe, Ga.	Sept. 11
Sept. 25.	Rome, N. Y.	Sept. 11
Sept. 25.	Highlands, N. J.	Sept. 11
Sept. 25.	Summit, Ill.	Sept. 11
Sept. 25.	Fort Morgan, Ala.	Sept. 11
Sept. 26.	Fort Barrancas, Fla.	Sept. 11
Sept. 27.	Washington, D. C.	Sept. 4
Sept. 27.	Hesperus, Colo.	Sept. 11
Sept. 28.	Manassas, Va.	Sept. 11
Sept. 30.	Wilmington, Del.	Sept. 11

Miscellaneous.

Sept. 11.	Cincinnati, O.,	Dike and Dam,	Aug. 21
Sept. 12.	Millen, G. A.,	Electric Light and Water Plant,	Aug. 28
Sept. 14.	Napanoch, N. Y.,	Power House,	Sept. 4
Sept. 14.	Ashland, Wis.,	Electric Plant,	Sept. 11
Sept. 16.	Stockton, Cal.,	Bulkhead,	Aug. 28
Sept. 16.	St. Paul, Minn.,	Cleaning Out Weeds,	Sept. 11
Sept. 18.	Roswell, N. Mex.,	Concrete Work,	Sept. 11
Sept. 19.	Boston, Mass.,	Wrecking Work,	Sept. 4
Sept. 19.	Kansas City, Mo.,	Tree Planting,	Sept. 11
Sept. 20.	Indianapolis, Ind.,	Dam Repairs,	Sept. 11
Sept. 21.	Portsmouth, N. H.,	Power House,	Sept 4
Sept. 25.	Reading, Pa.,	Subway,	Sept. 11
Sept. 25.	Vancouver Barracks, Wash.,	Coal Sheds, Scale,	Sept. 11
Sept. 26.	Fort Dupont, Delaware City, Del.	Freight Wharf,	Sept. 4
Sept. 26.	Fort Dupont, Del.,	Wharf Work,	Sept. 11
Sept. 27.	Pittsburg, Pa.,	Monument,	Sept. 11
Sept. 30.	Washington, D. C.,	Search Light Outfit,	Aug. 7
Sept. 30.	Cincinnati, O.,	Dredge,	Sept. 11
Sept. 30.	Philadelphia, Pa.,	Dredge,	Sept. 11
Oct. 1.	Winnipeg, Man.,	Hydro-Electric Station,	Sept. 4
Oct. 1.	Fort Dade, Fla.,	Wire Fence,	Sept. 11
Oct. 3.	Wilmington, Del.,	Stone Jetties,	Sept. 11
Oct. 5.	Franklin Shoals, Ark.,	Lock and Dam,	Aug. 7
Oct. 5.	Mobile, Ala.,	Locks and Dams,	Aug. 14
Oct. 5.	Mobile, Ala.,	Locks and Dams,	Sept. 11
Oct. 5.	Vicksburg, Miss.,	Lock and Dam,	Aug. 14
Oct. 31.	Mobile, Ala.,	Snagboat,	Sept. 11
Nov. 15.	Charleston, S. C.,	Street Lighting,	Sept. 11

Excavation, Earth and Rock.

Sept. 11.	Bradley, Ark.,	Levee Work,	Sept. 4
Sept. 11-12.	Estherville, Ia.,	Ditch Work,	Sept. 4
Sept. 12.	Rich, Ill.	Drainage Ditches,	Aug. 28
Sept. 14.	Moultrieville, S. C.,	Dredging Filling In.,	Aug. 28
Sept. 14.	Washington, D. C.,	Filling,	Sept. 11
Sept. 14.	Memphis, Tenn.,	Ditch,	Sept. 11
Sept. 14.	St. Peter, Minn.,	Ditch,	Sept. 11
Sept. 14.	Montevideo, Minn.,	Ditch Work,	Sept. 11
Sept. 16.	Plaquemine, La.,	Earth Filling,	Sept. 4
Sept. 16.	Newport, R. I.,	Drill Ground,	Sept. 4
Sept. 16.	Canton, O.,	Ditch,	Sept. 11
Sept. 16.	Chicago, Ill.,	Excavation,	Sept. 11
Sept. 17.	Clayton, Mich.,	Drain,	Sept. 4
Sept. 18.	Seattle, Wash.,	Dredging,	Sept. 4
Sept. 18.	St. Charles, Ill.,	Drains,	Sept. 11
Sept. 18.	Washington, D. C.,	Dredging,	Sept. 11
Sept. 19.	Gardner, Me.,	Dredging,	Aug. 28
Sept. 19.	Boone, Ia.,	Tile Drain,	Sept. 11
Sept. 20.	Dakotah, Ia.,	Drain,	Sept. 11
Sept. 23.	Bay City, Mich.	Embankment,	Sept. 11
Sept. 26.	San Francisco, Cal.,	Dredging,	Sept. 11
Sept. 30.	New York, N. Y.,	Dredging and Rock Removal,	Sept. 4
Sept. 30.	Boston, Mass.,	Dredging,	Sept. 11
Oct. 7.	Detroit, Mich.,	Excavating,	Sept. 4
Oct. 8.	Detroit, Mich.,	Dredging,	Sept. 4
Oct. 10.	Peterboro, Ont.,	Canal,	Sept. 4

Materials, Machines, Supplies, Tools Etc

—	York, Pa.,	Paving Brick,	Sept. 11
Sept. 12.	Jefferson Barracks, Mo.,	Boilers,	Sept. 4
Sept. 12.	Washington, D. C.,	Tugboat,	Sept. 11
Sept. 13.	Lawrenceburg, Tenn.,	Machinery,	Sept. 4
Sept. 14.	Manila, P. I.,	Valves, Gates,	July 31
Sept. 14.	New York, N. Y.,	Motor Generator Sets,	Aug. 28
Sept. 16.	Albany, N. Y.,	Asphalt Blocks,	Sept. 11
Sept. 16.	Reading, Mass.,	Arc Lamps,	Sept. 11
Sept. 16.	Pittsburg, Pa.,	Lumber,	Sept. 11
Sept. 17.	New Orleans, La.,	Lumber and Piling,	Sept. 4
Sept. 17.	Wyandotte, Mich.,	Boiler, Generator, Etc.,	Sept. 11
Sept. 17.	Norfolk, Va.,	Hoist Blocks, Etc.,	Sept. 11
Sept. 17.	New York, N. Y.,	Cement, Electrical Supplies, Etc.,	Sept. 11
Sept. 17.	Portsmouth, N. H.,	Sheaves,	Sept. 11
Sept. 17.	Annapolis, Md.,	Machinery,	Sept. 11
Sept. 17.	Washington, D. C.,	Ties, Milling Cutters,	Sept. 11
Sept. 18.	Washington, D. C.,	Pneumatic Tools, Etc.,	Sept. 11
Sept. 20.	Chicago, Ill.,	Electric Light Wire,	Sept. 11
Sept. 25.	Washington, D. C.,	Machinery,	Sept. 4
Sept. 30.	Cincinnati, O.,	Dredging,	Sept. 4
Sept. 30.	Los Angeles, Cal.,	Water Pipe and Pumping Machinery,	Sept. 4
Sept. 30.	West Point, N. Y.,	Gas and Electric Fixtures,	Sept. 4
Sept. 30.	New London, Conn.,	Generating Sets,	Sept. 11
Sept. 30.	Rochester, N. Y.,	Electric Plant,	Sept. 11
Oct. 1.	Mare Island, Cal.,	Brick, Pump, Etc.,	Sept. 11
Oct. 4.	Jacksonville, Fla.,	Generator, Etc.,	Sept. 11
Oct. 5.	Washington, D. C.,	Launch, Hammers, Bolts, etc.,	Sept. 11
Oct. 15.	Honolulu, T. H.,	Materials,	Sept. 4

BIDS ASKED.

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by state:

Los Angeles, Cal.—Until 11 a. m., Oct. 14, by H. B. Ferris, Sec'y Bd. Pub. Wks., for construction and reinforced concrete bridge at Seventh St., bridge to be 318 ft. long, 70 ft. wide and to contain about 5,440 cubic yards cement.

Oakland, Cal.—Until noon, Sept. 30, by Lt. Col. John Biddle, U. S. Engr., 1840 Polk St., San Francisco, for painting government bridges over Oakland Harbor.

Oakland, Cal. Until 12 noon, Sept. 30, by Lt. Col. John Biddle, U. S. Engrs., 1840 Polk St., San Francisco, for painting government bridges over Oakland Harbor.

Greeley, Colo.—Until Sept. 20, by T. W. Jaycox, State Engineer, Denver, for constructing 135 ft. reinforced concrete bridge at Greeley.

Denver, Colo.—Until noon Sept. 27, by T. W. Jaycox, State Engineer, for constructing 80 ft. steel bridge and approaches.

Denver, Colo.—Until noon, Sept. 27, by T. W. Jaycox, State Engineer, for constructing 80 ft. steel bridge and approaches.

Fort Wayne,, Ind.—Until 10 a. m., Sept. 18, by County Commissioners for approaches to bridge in Maumee Township.

Fort Wayne, Ind.—Until 10 a. m., Sept. 18, by Geo. W. Lindemuth, County Auditor, for building approach to river bridge, Maumee Township; also for creosote block floor on Turner bridge, Marion Township.

Fort Wayne, Ind.—Until 10 a. m., Sept. 18, by Geo. W. Lindemuth, County Auditor, for building approach to river bridge, Maumee Township; also for creosote block floor on Turner bridge, Marion Township.

Salem, Ind.—Until 1:30 p. m., Oct. 7, S. G. Ellis, County Auditor, for construction of steel bridge and stone abutments near Old Pekin.

Minneapolis, Minn.—Until 11 a. m., Sept. 16, by Hugh R. Scott, County Auditor, for bridge No. 290, contract No. 19.

Albany, N. Y.—Until 3 p. m., Sept. 16, by Isidore Wachsman, Clk. Bd., contract and supply, for cleaning and painting Northern boulevard bridge over N. Y. C. & H. R. R. R.

Cincinnati, O.—Until Sept. 20, by M. J. Keefe, Clk. Bd. Pub. Wks., for repair of structural steel work, Liberty St. Viaduct.

Cincinnati, O.—Until Sept. 20, by M. J. Keefe, Clk. Bd. Pub. Wks., for repair of structural steel work of Liberty St. viaduct.

Sherman, Tex.—Until Sept. 16, by City Secretary, for constructing 75 ft. 16-ft. roadway steel bridge.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Childersburg, Ala.—Until 1 p. m., Sept. 14, by D. L. Lewis, Sycamore, Ala., for Coosa River Spinning Co., for erecting cotton mill building and warehouse near here. Plans, with Knox, Dixon & Burr, Talladega, Ala.

San Diego, Cal.—Until 7:30 p. m., Oct., 14, by Board Education, for erecting brick or reinforced concrete, 16-room school building. H. L. Gay, Arch., Room 56, Keating Block, San Diego.

Soldiers' Home, Cal.—Until noon Sept. 17, by T. J. Cochrane, Treasurer Pacific Branch, N. H. D. V. S., for construction of morgue.

Riverside, Cal.—Until 2 p. m., Sept. 26, by Office of Indian Affairs, for erecting two cottages, stable, additions to mess hall and laundry, all of brick; for frame dormitory and for combined cold storage and coal house of brick with equipment. Harwood Hall, Supt. Riverside School, Riverside.

Washington, D. C.—Until 2 p. m., Sept. 17, for installing heating apparatus in medical building of Howard University. Dr. H. S. Scurlock, 531 Florida Ave., N. W.

Washington, D, C.—Until 11:30 a. m., Sept. 23, by Maj. J. T. Crabbs, Constructing Q. M., Takoma Substation, Washington, for construction, including plumbing, gas piping and electric lighting, of a double set of hospital corps sergeants' quarters, at Walter Reed Army General Hospital, Washington, D. C.

Washington, D. C.—Until noon, Sept. 14, by District Commissioners, for constructing addition to Petworth School building. J. J. Morrow, Engineer Commissioner.

Hesperus, Cal.—Until 2 p. m., Sept. 27, by Office of Indian Affairs, for erecting office and school building, a laundry and addition to boy's dormitory, all of brick. John S. Spear, Supt. Fort Lewis School, Hesperus.

Des Moines, Ia.—Until 3 p. m., Oct. 21, by James Knox Taylor, Supervising Arch., Washington, D. C., for construction complete of U. S. Postoffice.

Des Moines, Ia.—Until 11 a. m., Sept. 12, by Board Public Works for constructing 2-story brick fire station building.

Muscatine, Ia.—Until Sept 26, by A. S. Lawrence, County Auditor, for erection of fireproof country court house.

Kankakee, Ill.—Until Sept. 17, by Directors Y. M. C. A., for erecting 3-story building.

Chicago, Ill.—Until 1 p. m., Sept. 18, at office Perkins & Hamilton, Archs., 1218 Hartford Bldg., for construction and equipment of addition to public comfort station in Lincoln Park.

Chicago, Ill.—Until 11 a. m., Sept. 18, by John J. Hanberg, Commissioner Pub. Wks., City Hall, for constructing 2-story and basement brick and stone bath house at W. Twelfth Pl. and Union St.

Chicago, Ill.—Until noon, Sept. 30, by business Manager, Board of Education, 730 Tribune Bldg., for gas and combination lighting fixtures, electric wiring and fixtures for Sunday schools.

Decatur, Ind.—Until Sept. 14, by Wm. Baudenbush, Trustee Blue Creek Township, for erection of school building.

Peoria, Ill.—Until 3 p. m., Oct. 17, by James Knox Taylor, Supervising Architect, Washington, D. C., for construction of extension, including mechanical equipment (except lift) to U. S. post office.

New Orleans, La.—Until 11 a. m., Oct. 5, by Bureau Yards and Docks, Washington, D. C., for installing hot water heating plant at naval station.

Agricultural College, Mich.—Until noon, Sept. 18, by A. M. Brown, Secy. State Board of Agriculture, for construction of agricultural building at Michigan College of Agriculture. E. A. Bowd, Arch., Lansing, Mich.

Oxly, Mo.—Until Sept. 15, by Father Smyth, for erection of Catholic church building.

Kansas City, Mo.—Until 2 p. m., Sept. 13, by Everett Elliott, Sec'y Pub Wks., for fire station No. 4. Root & Siemens, Arch., 791 Postal Bldg.

Bayonne, N. J.—Until 8:30 p. m., Oct. 3, by R. T. Hewitt, Sec'y Board of Education, for public school building No. 9. A S. Longyear, Arch., 126 Liberty St., New York.

Cape May, N. J.—Until 11 a. m., Sept. 14, by Maj. C. A. F. Flagler, U. S. Engrs., Wilmington, Del., for constructing building at Cape May.

Montclair Heights, N. J.—Until 2:30 p. m., Sept. 17, by Edw. Ross, Chairman Building Committee, State House, Trenton, for boiler house and heating plant, Normal School, Montclair Heights.

Edgewater, N. J.—Until 8 p. m., Sept. 18, by G. E. Booth, Boro. Clerk., for alterations to municipal building.

Albany, N. Y.—Until 11 a. m., Sept. 16, by D. W. Cahill, Supt. of Public Buildings, Capitol, for constructing new mezzanine floor, and changes in main entrance doorway, executive department, Capitol.

West Point, N. Y.—Until noon, Sept. 30, by Maj. J. M. Carson, Jr., Q. M., to furnish and install combination gas and electric light fixtures, in cadet barracks.

Chauncey, O.—Until Sept. 14, by R. C. Gardner, Village Clk., for erecting village prison.

Cincinnati, O.—Until Sept. 18, by Board for constructing comfort station at Fifth St. Estimated cost $25,000. Gustave W. Drach, Arch.

Danville, Pa.—Until noon, Sept. 24, for erection of 3 buildings at State Hospital for Insane. Dr. H. B. Meredith, Supt. T. P. Reitmyer, Arch., Masonic Temple, Williamsport, Pa.

Scotland, Pa.—Until 6 p. m., Sept. 16, for erection of chapel and dormitory building and alterations to present building at Soldiers' Orphans' Industrial School, Capt. Geo. W. Skinner, Supt. A. A. Ritcher, Arch., Lebanon and Reading, Pa.

Fort Myer, Va.—Until 11 a. m., Sept. 16, by Capt. E. B. Hyer, Contracting Q. M., for addition to cavalry ball.

Delavan, Wis.—Until noon, Sept. 18, by State Board of Control, Madison, for industrial building, stable and cow barn at Wisconsin School for Deaf. Howland Russel, Arch., Milwaukee, Wis.

Roads and Streets

Bids are asked on following work, the notes being arranged alphabetically by state:

Washington, D. C.—Until noon, Sept. 21, by District Commissioners, for laying cement sidewalks. Jay J. Morrow, Engineer Commissioner.

Des Moines, Ia.—Until noon, Sept. 19, by Board Public Works, for 4,317 sq: yds. of brick paving; also for 1,925 lin. ft. of curbing. Bids are also asked until 11 a. m., Sept. 21, for paving Sixth Ave. with brick, and for 700 lin. ft. cement curbing on Arlington Ave.

Des Moines, Ia.—Until 11 a. m., Sept. 13, by Board Public Works, for 1,084 sq. yds. asphalt paving and 562.5 lin. ft. cement curb; also until Sept. 16 for (1) 11,000 cu. yds. grading of road (2) 5,200 sq. yds. vitrified block paving; also until Sept. 19 for 4,312 sq. yds. vitrified brick block paving.

Pontiac, Ill.—Until 2 p. m., Sept. 14, by Wm. Mathewson, Sec'y Bd. Local Improvements, for constructing 5,412 sq. yds. brick pavement and 3,580 lin. ft. sandstone curb.

Quincy, Ill.—Until 2 p. m., Sept. 18, by Board Local Improvements, for constructing 14,230 sq. yds. brick pavement, 6,821 lin. ft. sandstone curb and 6,688 cu. yds. excavation. Official advertisement will be found elsewhere in this issue. F. L. Hancock, City Engineer.

Peru, Ind.—Until noon, Sept. 14, by Chas. Griswold, County Auditor, for 23½ miles of gravel road work in Richland Township.

Vincennes, Ind.—Until 2 p. m., Sept. 28, by County Commissioners, for construction of 16,019 ft. of gravel road.

Decatur, Ind.—Until 6 p. m., Sept. 12, by C. O. France, City Clerk, for paving Seventh St. with brick.

Salem, Ind.—Until 1:30 p. m., Oct. 7, by S. G. Ellis, County Auditor, for 24,165 ft. of gravel road in Washington Township; est. cost, $11,949; also for 6,733 ft. gravel road in Monroe Township, ets. cost, $3,914.

Vincennes, Ind.—Until noon, Oct. 8, by J. L. Ackerman, County Auditor, for 8,000 ft. of gravel road in Vincennes Township.

Fort Wayne, Ind.—Until 7:30 p. m., Sept. 19, by H. W. Becker, Clerk, Bd. Pub. Wks., for (1) 3 cement sidewalks (2) grading and cement sidewalk, (3) vitrified block paving on 1 street, (4) asphalt pavement on 1 street.

Danville, Ill.—Until 7:30 p. m., Sept. 26, by Board Local Improvements for 4 paving contracts.

Evansville, Ind.—Until 4 p. m., Sept. 16, by W. F. Wunderlich, Clerk, Dept. Pub. Wks., for 6 ft. artificial stone sidewalk.

Indianapolis, Ind.—Until 10 a. m., Sept. 13, by Board Public Works, for 5 contracts, grading and paving sidewalks; 2 contracts, grading rolling roadway; 2 contracts, grading and paving roadway.

Frankfort, Ind.—Until 10 a. m., Sept. 20, by County Auditor, for 18,408 ft. gravel road.

Logansport, Ind.—Until 10 a. m., Sept. 17, by Chas. Ringleben, Chairman Bd. Pub. Wks., for 7 contracts for grading, graveling, guttering and bouldering streets.

Terre Haute, Ind.—Until 4 p. m., Sept. 13, by Herbert Briggs, Secy. Bd. Pub. Wks., for 2 contracts, for improving streets; certified checks for $400 and $800 required.

Sunman, Ind.—Until 6 p. m., Oct. 14, by E. R. Behlmer, Town Clk., for cement sidewalks.

Chanute, Kan.—Until 5. p. m., Sept. 13, by W. F. Sams, City Clerk, for paving N. Grant Ave. with vitrified brick.

Waseca, Minn.—Until Sept. 17, by John Madigan, City Clerk, for laying 17,207 sq. ft. of brick block paving.

Louisville, Ky.—Until noon, Sept. 16, by R. G. McGrath, Secy. Bd. Pub. Wks., for furnishing hot mixed asphalt and repairing asphalt streets.

Grand Rapids, Mich.—Until 8 p. m., Sept. 12, by S. A. Freshney, Sec'y Bd. Pub. Wks., for grading and paving E. Bridge St.

St. Joseph, Mich.—Until 5 p. m., Sept. 18, by H. L. Murphy, City Clerk, for grading and paving with brick on 2 streets.

Eveleth, Minn.—Until 8 p. m., Sept. 17, by Edw. Skeel, City Clerk, for building artificial stone and cement sidewalk. J. E. Carroll, Engineer, Crookston, Minn.

St. Paul, Minn.—Until 10 a. m., Sept. 16, by E. G. Krahmer, County Auditor, for improvement of Carpenteur Ave.

Winona, Minn.—Until 8:30 p. m., Sept. 16, by Paul A. Jasmer, City Recorder, for paving alley with brick.

Kansas City, Mo.—Until 2 p. m., Sept. 17, by Everett Elliott, Sec'y Board Pub. Wks., for annual repairs to first-class sidewalk and curbing for year ending July 1, 1908.

Kansas City, Mo.—Until 11 a. m., Sept. 19, by E. A. Harper, City Engineer, for five contracts for artificial stone curbing and 23 contracts for artificial stone sidewalks.

Kansas City, Mo.—Until 3 p. m., Sept. 16, Frank P. Gossard, Sec'y Park Commissioners, for constructing artificial stone sidewalks in Gillham Road.

Woodcliff Lake, N. J.—Until 8 p. m., Sept. 24, by the Mayor, for constructing 13,768 ft. macadam road; also for a 9,745 ft. macadam. H. G. Hering, Jr., Boro. Engr., Hillsdale, N. J.

Weehawken, N. J.—Until 8 p. m., Sept. 16, by Thos. Carroll, Township Clk., for regulating and paving Clifton Road. Geo. W. Bond, Jr., Engineer, 148 Bullsferry Road.

Albany, N. Y.—Until 3 p. m., Sept. 16, by Isidore Wachsman, Clerk Bd. Contract and Supply, for paving Sheridan Av. with granite blocks and Bradford St. with vitrified blocks.

Brooklyn, N. Y.—Until 11 a. m., Sept. 18, by Bird S. Coler, Boro. President, for work under six contracts for street improvement. Largest contract calls for 18,620 sq. yds. asphalt pavement.

Buffalo, N. Y.—Until 11 a. m., Sept. 20, by F. G. Ward, Commissioner Pub. Wks., for repaving portions of five streets.

Union (Hudson County), N. Y.—Until 8 p. m., Sept. 16, by Emil Bautz, Town Clk., for macadamizing; certified check for $1,000.

Devils Lake, N. Dak.—Until noon, Sept. 16, by Ole Saratass, City Auditor, for grading portions of six streets.

Cleveland, O.—Until 11 a. m., Sept. 14, by Julius C. Dorn, County Clk., for repairing portions of Euclid Road, Euclid Township.

Cincinnati, O.—Until noon, Sept. 19, by M. J. Keefe, Clk. Bd. Pub. Wks., for 2 contracts for wood block paving, 1 contract for brick paving, 1 contract for macadamizing.

Cincinnati, O.—Until noon, Sept. 20, by Fred Dreihs, Clk. County Commissioners, for improvement Montgomery Pike, under Specifications No. 668.

Silverton, O.—Until noon, Sept. 21, by A. A. Sprague, Village Clerk, for cement sidewalks.

Toledo, O.—Until noon, Sept. 12, by Reynold Voit, Secy. Bd. Pub. Wks., for paving.

Fort Moultrie, S. C.—Until 11 a. m., Sept. 14, by J. M. Fulton, Q. M., for constructing roads and walks.

Dallas, Tex.—Until 3 p. m., Sept. 20, by J. B. Winslett, City Sec'y, for paving Ross Ave. and Main St. Official advertisement will be found elsewhere in this issue.

Manassas, Va.—Until Sept. 28, by O. E. Newman, for macadamizing a number of streets. Pressey & Weller, Engineers, 1416 F St. N. W., Washington, D. C.

Racine, Wis.—Until 10 a. m., Sept. 21, City Clerk, for grading several streets.

Billings, Mont.—Until 8 p. m., Oct. 1, by J. D. Matheson, City Clerk, for constructing 6,305 sq. yds. of shale brick pavement; also for 58,653 sq. yds. gravel macadam, 3,000 lin. ft. of sewer and 17,400 lin. ft. of gutter.

Milwaukee, Wis.—Until 10:30 a. m., Sept. 14, by Charles J. Poetsch, Chairman Bd. Pub. Wks., for removing old cedar block pavements and for macadamizing on Fourth St., also for resurfacing with asphalt on Third St. Bids also asked until Sept. 17, for paving with bitulithic portions of Twelfth St., Lake Drive and Teutonia Ave.

Sewers.

Bids are asked in following work, the notes being arranged alphabetically by states:

Oakland, Cal.—Until 11 a. m., Sept. 18, by W. B. Fawcett, Secy. Bd. Pub. Wks., for concrete and ironstone intercepting sewer in Wood St.

Fort Dade, Fla.—Until 8 p. m., Oct. 3, by Constructing Q. M., for repair and extension of sewer outlet.

Chicago, Ill.—Until 11 a. m., Sept. 18, by John J. Hanberg, Comr. Pub. Wks., City Hall, for constructing 450 ft. of sewer in S. Peoria, St.

Chicago, Ill.—Until 11 a. m., Sept. 18, by O. E. Chapin, Sec'y Bd. Local Improvements, 216 City Hall, for ten contracts for tile pipe sewers.

North Chicago, Ill.—Until noon, Sept. 27, by Bureau of Navigation, Washington, D. C., for sewers and drains at naval training station, Great Lakes, North Chicago, where plans, etc., may be obtained.

Winamac, Ind.—Until 7 p. m., Sept. 12, by City Trustees, for constructing sewer.

Fort Wayne, Ind.—Until 7:30 p. m., Sept. 19, by H. W. Becker, Clk. Bd. Pub. Wks., for 3 vitrified pipe sewers.

Cadillac, Mich.—Until Oct. 1, by Bd. Pub. Wks., for building sewerage disposal plant. A. J. Teed, Cy. Engr.; Geo. S. Pierson, Kalamazoo, Mich., Consult. Engr.

Paducah, Ky.—Until 3 p. m., Oct. 1, by L. A. Washington, City Engineer, for constructing 14 miles 6-in. vit. pipe sewer laterals, 6 ft. to 12 ft. deep.

Boston, Mass.—Until noon, Sept. 12, by John J. Leahy, Supt. Sewers, 30 Tremont St., for sewerage work in Morton St.

Ypsilanti, Mich.—Until 9 a. m., Sept. 16, by City Clerk, for constructing 750 ft. 24-in. and 2,050 ft. 20-in. pipe sewer. City will furnish pipe and brick.

Winona, Minn.—Until 8:30 p. m., Sept. 16, by Paul A. Jasmer, Cy. Recorder, for sanitary sewer.

Aurora, Neb.—Until noon, Sept. 21, by Dennis Saylor, City Clerk, for constructing sewer system. Est. cost is $10,500.

Summit, N. J.—Until 8:30 p. m., Sept. 17, by J. Edw. Rowe, City Clerk, for constructing 4 East Summit lateral sewer No. 3, consisting of 4,200 ft., 8-in. and 10-in. pipe sewer, and Mountain Ave. sewer, consisting of 460 ft. 8-in. pipe sewer. Wm. S. Logan, City Engr.

Brooklyn, N. Y.—Until 11 a. m., Sept. 18, by Bird S. Coler, Boro. President, for constructing 33 sewer basins.

Brooklyn, N. Y.—Until 11 a. m., Sept. 18, by Bird S. Coler, Boro. President, for constructing sewer in Flatbush Ave. extension, estimated to cost $46,897; also another sewer in same extension, estimated to cost $18,407.

Dayton, O.—Until noon, Sept. 13, by W. A. Maynes, Clk. Bd. Pub. Wks., for 40 ft. 18 in. sewer, 600 ft. 24 in. sewer, etc.

Delaware, O.—Until 6 p. m., Sept. 27, by T. F. Dye, Secy. Trustees Girl's Industrial Home, for sewage disposal plant, work including sewers, septic tank, sprinkling filters, settling tanks, etc. E. G. Bradbury and G. P. Shute, Engineers, 85 N. High St., Columbus, O.

Hamilton, O.—Until noon, Sept. 21, by A. Rothwell, Secy. Bd. Pub. Serv., for sanitary sewer; also for storm water sewer.

Philadelphia, Pa.—Until noon, Sept. 17, by Geo. R. Stearns, Director Pub. Wks., for contract No. 132, sewer connecting Upper Roxborough filters. Plans, etc., with Chief Engineer, Bureau of Filtration, 712 City Hall.

Water Supply

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Morgan, Ala.—Until 11 a. m., Sept. 25, by Capt. Louis F. Garrard, Jr., Box 605, Mobile, Ala., for construction of 150,000 gal. tank and trestle; also for pumping plant, ice machine and cold storage.

Ukiah, Cal.—Until 10 a. m., Sept. 14, by W. W. Cunningham, Secy. Board Managers, Mendocino State Hospital, for steel water tower and tank for hospital. Plans, etc., at hospital, with State Engineer, Sacramento and N. Clark & Sons, 17 Spear St., San Francisco.

Hesperus, Colo.—Until 2 p. m., Sept. 27, by Office of Indian Affairs, Washington, D. C., for improvements to water system, Fort Lewis School. John S. Spear, Supt. of School.

Wilmington, Del.—Until 1:30 p. m., Sept. 30, by T. A. Leisen, Chief Engineer Water Department, for construction of covered low sand filters consisting of six beds and a covered filtered water reservoir with a capacity of 10,000,000 gallons, together with all appurtenances.

Fort Barrancas, Fla.—Until Sept. 26, by Lieut. A. L. Rhoades, Q. M., for constructing 200,000-gallon reinforced concrete reservoir, installing one steam pump and one steam air compressor and extending water mains.

Fort Oglethorpe, Ga.—Until 11 a. m., Sept. 21, by Capt. E. D. Anderson, Q. M., for deep well and water system at GovernmentTarget Range, Cartoosa Springs, Ga.

Lindsay, Neb.—Until 8 p. m., Sept. 12, by H. J. Finch, Village Clerk, for well, stand-pipe, pipe line, pump, etc.

Highlands, N. J.—Until 8:30 p. m., Sept. 25, for material and labor for erection of municipal waterworks to include power house, stand-pipe, pump, pipe line, driven wells., etc. Plans, etc., with Runyon & Carey, Engrs., 122 Market St., Newark, N. J.

Fort H. G. Wright (P. O., New London, Conn.) N. Y.—Until Sept. 16, by Capt. Wm. E. Horton, Constructing Q. M., to furnish and lay 1,550 ft. of 4-in. water pipe.

Rome, N. Y.—Until noon, Sept. 25, by Water and Sewer Commissioners, for construction of dam on Fish Creek; also 5,500 ft, of tunnel. Knight & Hopkins, Engineers, Rome, N. Y.

Summit, Ill.—Until 8 p. m., Sept. 25, by Jas. Johnstone, Village Clerk, for drilling 1,600-ft. well.

Gregory, S. Dak.—Until 5 p. m., Sept. 14, by F. M. Ziebach, Chairman Town Trustees, for constructing water works. Western Engineering Co., Yankton, S. Dak., are the engineers.

Lawrenceburg, Tenn.—Until Sept. 13, by this city, for constructing concrete-steel water works tower 100 ft. high and 100,000 gal. tank. W. G. Kirkpatrick, Engineer, Jackson, Miss.

Excavation—Earth and Rock

Bids are asked on following work, the notes being arranged alphabetically by states:

San Francisco, Cal.—Dredging—Until noon, Sept. 26, by Lt. Col. John Biddle, U. S. Engrs., 1840 Polk St., for dredging in Petaluma Creek.

Washington, D. C.—Filling—Until noon, Sept. 14, by District Commissioners, for 90,000 cu. yds. filling for approaches to Anacostia bridge. Jay J. Morrow, Engineer Commissioners.

Washington, D. C.—Dredging—Until noon, Sept. 18, by Maj. Spencer Cosby, U. S. Engrs., for dredging in Occoquan, Urbana and Carter's Creek and Mattaponi River, Va.

Boone, Ia.—Tile Drain—Until 1 p. m., Sept. 19, by E. F. Jones, County Auditor, for constructing County Drain No. 1, including 11,941 ft., 12 to 28 in. clay or cement tile.

Dakotah, Ia.—Drain—Until Sept. 20, by John Cunningham, County Auditor, for constructing ditch.

Chicago, Ill.—Excavation—Until 2 p. m., Sept. 16, by Board of Inspectors, House of Correction, 26th and California Ave., for excavation of 30,000 cu. yds. of dry material on the grounds of the House of Correction.

St. Charles, Ill.—Drains—Until 11 a. m., Sept. 18, by C. W. Hart, Sec'y St. Charles

School for Boys, at office of T. D. Hurley, 1214 Unity Bldg., Chicago, for constructing system of connected drains.

Boston, Mass.—Dredging—Until noon, Sept. 30, by Maj. Edw. Burr, U. S. Engrs., for dredging in Mystic River, Mass.

Bay City, Mich.—Embankment—Until noon, Sept. 23, by John H. Bloomshield, Engr., Bay County Bridge Commission, for dredging or otherwise constructing an embankment containing about 50,000 cu. yds.

Montevideo, Minn.—Ditch Work—Until 10 a. m., Sept. 14, by F. J. Rubertus, County Auditor, for constructing ditch No. 9.

St. Peter, Minn.—Ditch—Until 2 p. m., Sept. 14, by A. H. Freeman, County Auditor, for constructing ditch No. 47.

Canton, O.—Ditch—Until 10 a. m., Sept. 16, by County Commissioners, for constructing ditch; est. cost is $11,500.

Memphis, Tenn.—Ditch—Until 10 a. m., Sept. 14, by F. M Guthrie, 70 Madison Ave., for cutting 20-ft. canal across sand bar in Wolf River.

Miscellaneous

Bids are asked on following work, the notes being arranged alphabetically by states:

Mobile, Ala.—Locks and Dams—Until 11 a. m., Oct. 5, by Maj. H. Jersey, U. S. Engrs., for building locks and dams Nos. 2 and 3, and lock-tender's house, Tombigbee River, Ala.

Mobile, Ala.—Snagboat—Until 11 a. m., Oct. 31, by Maj. H. Jervey, U. S. Engrs., for construction of wooden hull, stern wheel snagboat.

Fort Dupont, Delaware City, Del.—Wharf Work—Until 11 a. m., Sept. 26, by Capt. J. L. Knowlton, Constructing Q. M., for reconstruction of freight wharf.

Wilmington, Del.—Stone Jetties—Until 11 a. m., Oct. 3, by Maj. C. A. Flagler, U. S. Engrs., for constructing stone jetties, Cold Springs Inlet, N. J., involving 285,000 tons of stone.

Fort Dade, Fla.—Wire Fence—Until 8 p. m., Oct. 1, by Lt. Turtle, Q. M., for construction of woven wire fence.

Indianapolis, Ind.—Dam Repairs—Until 10 a. m., Sept. 20, by Park Commissioners, for repairing apron to Riverside Park dam.

St. Paul, Minn.—Cleaning Out Weeds—Until 10 a. m., Sept. 16, by Edw. G. Krahmer, County Auditor, for cleaning out weeds, mud, etc., from 3 lakes, 12 acres in all.

Kansas City, Mo.—Tree Planting—Until 11 a. m., Sept. 19, by E. A. Harper, City Engr., for planting trees.

Roswell, N. M.—Concrete Work.—Until Sept. 18, by Arthur J. Stevens, Lock Box 45, for constructing 8,000 ft. of concrete ditch.

Cincinnati, O.—Dredge—Until 2 p. m., Sept. 30, by Maj. J. G. Warren, U. S. Engrs., for constructing dredge. Information may be obtained from W. H. McAlpine, Asst. Engr., Frankfort, Ky.

Pittsburg, Pa.—Monument—Until noon, Sept. 27, by F. P. Booth, County Controller, for construction of Allegheny County Soldiers' Memorial; certified check for $5,000. Plans, etc., with County Engineer, Room 25, Court House.

Philadelphia, Pa.—Dredge—Until 2:30 p. m., Sept. 30, by Maj. J. C. Sanford, U. S. Engrs., for constructing steel hull, 16 in. pump dredge, for Savannah River.

Reading, Pa.—Subway—Until 2 p. m., Sept. 25, by Caleb Weidner, City Clerk, for subway under P. & R. Ry. track at Spring St. Certified check for $15,000 required. Elmer H. Beard, City Engineer.

Charleston, S. C.—Street Lighting—Until noon, Nov. 15, by Don Simons, City Electrician, for street lighting for terms of one, two or four years.

Vancouver Barracks, Wash.—Coal Sheds, Scale—Until 11 a. m., Sept. 25, by Constructing Q. M., for construction of two coal sheds and railroad track scale.

Ashland, Wis.—Electric Plant—Until 10 a. m., Sept. 14, by Board Public Works, for constructing dam, light and power works and transmission system. James Phillips, City Engr.

Materials, Machines, Supplies, Tools, Etc

Bids are asked for the following, the notes being arranged alphabetically by states:

Mare Island, Cal.—Brick, Pump, Etc.—Until 10 a. m., Oct. 1, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard, fire brick, steam pump, belting, etc., under Schedule 285, and ash, boat knees, bar steel, pig iron under Schedule 286.

New London, Conn.—Generating Sets—Until noon, Sept. 30, by Maj. Harry Taylor, U. S. Engrs., for furnishing 10 or more 25 K. W. electric generating sets, each consisting of gasoline-driven multiple cylinder vertical engine direct connected to d. c. generator.

Washington, D. C.—Pneumatic Tools, Etc.—Until 10:30 a. m., Sept. 18, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Circular 384, steam riveting machine, pneumatic tools and hoist, electric drills, hose, etc.

Washington, D. C.—Tugboat—Until 10:30 a. m., Sept. 12, by H. F. Hodges, Gen. Purchasing Officer, Isthmian Canal Commission, for a tug boat under Circular 390.

Washington, D. C.—Ties, Milling Cutters—Until 10:30 a. m., Sept. 17, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard Schedule 271—ties and Schedule 277 milling cutters.

Washington, D. C.—Launch, Hammers, Bolts, Etc.—Until 10:30 a. m., Oct. 5, by H. F. Hodges, Gen. Purchasing Officer, Isthmian Canal Commission, for furnishing launch, steel jacks for steam shovels, tinner's machines and tools, spraying machines, hose, asbestos cement, pole cross arms, glass insulators, machine bolts, rivets, cotters, hooks and eyes, nails, screws, tacks, wire gaskets, wire netting, steel, bridge reamers, wrenches, hammers, screwdrivers, nail pullers, saw brushes, buckets, pulleys, etc., all under Canal Circular 391.

Jacksonville, Fla.—Generator, Etc.—Until noon, Oct. 4 ,by R. N. Ellis, Superintendent City Plant, for furnishing and placing one 1,500 K.-W. steam turbo generator and a 50 K.-W. motor-driven exerter.

Chicago, Ill.—Electric Light Wire—Until 11 a. m., Sept. 20, by William Carroll, City Electrician, City Hall, for furnishing 125 miles of No. 6 B. & S. gauge, triple braid, weatherproof, copper-lined wire.

Annapolis, Md.—Machinery—Until 10 a. m., Sept. 17, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at Naval Academy, under Schedule 273, core making machine, sterilizer, sand sifter, band saw machine, jig saw, lathe, air compressor, sand papering machine.

Wyandotte, Mich.—Boiler, Generator, Etc.—Until 8 p. m., Sept. 17, by J. G. Pinson, Sec'y Bd. Pub. Wks., for furnishing 300-hp. water tube boiler, 240-k.-w. generating unit, complete, generator panel, feeder panel and series enclosed a. c. arc lamp system.

Reading, Miss.—Arc Lamps—Until noon, Sept. 16, by Gilman L. Parker, Chairman Committee, for furnishing 140 are lamps for municipal light plant. Richard D. Kimball Co., Engineers, 6 Beacon St., Boston, Mass.

Portsmouth, N. H.—Sheaves—Until 10 a. m., Sept. 17, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard, under Schedule 277, metallic bushed sheaves.

Albany, N. Y.—Asphalt Blocks—Until 3 p. m., Sept. 16, by Isidore Wachsman, Clerk Board Contract and Supply, for 16,000 asphalt blocks for Bureau of Streets.

Rochester, N. Y.—Electric Plant—Until Sept. 30, by Commissioners of Building of Monroe County, G. L. Meade, Chairman, for furnishing and installing electric light plant for court house.

New York, N. Y.—Cement, Electrical Supplies, Etc.—Until 10 a. m., Sept. 17, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard, naval supplies among which are the following: Schedule 270, fuses, electrical supplies, Portland and linoleum cement, block pins and sheaves, lumber, pipe fittings, etc.

Pittsburg, Pa.—Lumber—Until noon, Sept. 16, by F. P. Booth, County Controller, for furnishing 150,000 ft. B. M. white oak road plank.

York, Pa.—Paving Brick—York Street Ry. Co. is asking bids for furnishing f. o. b., Hanover, 250,000 paving brick.

Norfolk, Va.—Hoist, Blocks, Etc.—Until 10 a. m., Sept. 17, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard, naval supplies among which are the following: Schedule 271, channels, eye bars, hoist engines; Schedule 277, steel bolts and nuts, copper rivets, engine lathe, pipe fittings, copper nails, turn-buckles, anvils, chisel bars, etc., files, forges, hammers, screws, steel wire brushes, hack-saw blades, twist drills, pipe taps, pulley blocks, hardware and tools.

CONTRACTS LET.

The following contracts have been let recently:

San Diego, Cal.—Railroad Grading—Rendell Frazier & Co., San Diego, first contract for grading San Diego & Arizona R. R., from San Diego to Yuma, Ariz.

Carmi, Ill.—Sewer—R. P. Winner, Carmi, at $3,987.

Marseilles, Ill.—School Building—Kraoi & Reiff, Marseilles.

McHenry, Ill.—Reinforced Concrete Bridge—Continental Bridge Co., Monadnock Block, Chicago, at $1,060.

Moline, Ill.—Street Work—The Tri-City Construction Co., for grading, draining and brick paving of 7th Ave., at $7,750.

Quincy, Ill.—Street Work—Henry Hummert, for grading Vine St., at 29 cents a cu. yd.

Indianapolis, Ind.—Street Work—The Hoosier Construction Co., for bitulithic roadway on 30th St.

Indianapolis, Ind.—Street Work—The Indianapolis Construction Co., Indianapolis, for brick paving using Portland cement

Indianapolis, Ind.—Sewer—The Sheehan Construction Co., Indianapolis, local sewer in Central Ave.

Mt. Vernon, Ind.—Road Construction—The Mt. Vernon Construction Co., Mt. Vernon, building gravel road at $12,000.

Bloomfield, Ind.—Sewers—Hamilton & Co., Chicago, Ill., 5 miles sewers at $20,080.

Goshen, Ind.—Street Work—W. W. Hatch & Sons, Goshen, macadamizing several streets.

Burlington, Ia.—School Building—H. Pierson & Son, Burlington, at $20,000.

Des Moines, Ia.—Reinforced . Concrete Bridge—The Marsh Bridge Co., Des Moines, at $124,800.

Manchester, Ia.—Sewer—Hutchinson & Atwater, Manchester, at $1,600.

Norway, Ia.—School Building—Theodore Stark, Norway, new high school building at $11,000.

Ottumwa, Ia.—Sewage Disposal Plant—R. C. De La Hunt, Cedar Rapids, at $13,995.

Garnett, Kas.—Electric Light Plant—Joseph Carey, Garnett, 20 year contract to construct and maintain electric light plant.

Leavenworth, Kas.—Street Work—O. C. Chapin, Leavenworth, brick paving on several streets.

Syracuse, Kas.—Railroad Station—C. A. Fellows, Topeka, new station and eating house at $54,000.

Louisville, Ky.—Sewer—R. L. Clark & Co., Louisville, Happy Hollow concrete sewer at $26,000.

Alexandria, La.—Library Building—Caldwell Bros., Abbeville, new Carnegie Library at $12,511.

Milford, Mass.—Sewer—Signore & De Santis, Boston, at $13,884.

Port Huron, Mich.—Sewer—Christie Walter, Port Huron, 3,000 ft. of sewer for Port Huron Engine & Thresher Co.

Bagley, Minn.—Bridge—Minneapolis Bridge & Iron Co., Minneapolis, across Clearwater River at $1,000.

Hastings, Minn.—Water Supply—S. Swenson Artesian Well Co., Minneapolis, drilling artesian well.

Kansas City, Mo.—Street Works—The Parker-Washington Co., paving McGee St. with asphalt at $2.05 a sq. yd.

Albany, N. Y.—Railroad Shop—R. Richard & Son, Utica, general contract for N. Y. Central shop at West Albany.

Rochester, N. Y.—Electric Railroad Construction—Summers, McDonald & Winters, New York City, building Dunsville and Hornell extension for Rochester, Corning and Elmira Traction Co.

New York, N. Y.—Ashokan Dam and Reservoir—Winston & Co., American Bank Bldg., Richmond, Va., at $12,600,000.

Canton, O.—Sewers—C. V. Sommer, Canton, the Meyer Ave. and West North St. sewers.—Natural Gas Co., Canton sewer on Harter Ave.

Cincinnati, O.—Viaduct—Evan Evans, Cincinnati, reconstruction of Harrison Ave., viaduct, at $18,655.

Dayton, O.—Street Work—Al. Wroe & Son, Dayton, cement paving, at $1,856.

Mansfield, O.—Sewer—Thomas Hildreth, Mansfield, sanitary sewer on Stewart Ave.

Springfield, O.—Railroad Station—John D. Raeder, Springfield, new Pennsylvania station.

Oklahoma City, Okla.—Bridges—C. G. Landon, Oklahoma City, bridges in Woods County at $18,000.

Norristown, Pa.—Road Work—Theobald Haish, Norristown, 2 miles macadam road at $15,000.

Philadelphia, Pa.—Manufacturing Plans—The William Steele & Sons Co., 2 large manufacturing plants at $100,000.

Nashville, Tenn.—Sewer. T. V. Barnsfield, at $1,339.

Brownsville, Tex.—Water Works and Electric Light Plant—Henry C. Ellen, Jr., Brownsville.

Center, Tex.—School Building—A. T. Fleshman and E. H. Barron, Center, building new school house.

Galveston, Tex.—Street Work—Kelso & Vautrin, brick paving the Boulevard at $1.60 per sq. yd.

Centralia, Wash.—Sewer System—The Northwest Bridge Co., Tacoma, trunk sewer system at $22,150.

Bolington, W. Va.—Union Station—The Enterprise Construction Co., Elkins, to build union station at $20,000.

M. & K. Junction, W. Va.—Union Station—R. B. Brown, Masontown, union station for the M. & K. and the B. & O. R. R.'s.

De Pere, Wis.—Sewer—Albert Luskins, De Pere, at 25c per ft. for 12 and 18 inch pipe and 20c per ft. for 8 inch pipe.

Milwaukee, Wis.—Street Work—Hase & Weiber, Milwaukee, sandstone paving on 7th at $3.13 a sq. yd. and granite paving on 5th St. at $3.09 a sq. yd.

North Milwaukee, Wis.—Sewers—F. E. Kaminski, Berlin, laying vitrified pipe sewers at $11,950.

Racine, Wis.—Sewers—Hans Hanson, Racine, lowering and enlarging sewer on Washington Ave.

Fort Dodge, Ia.—School Building—G. Proschhold, Fort Dodge, rebuilding high school at $38,285.

Iowa City, Ia.—Street Work—Bradley & Lehmann, Iowa City, paving and macadamizing.

Mason City, Ia.—Street Work—George Gabler, Mason City, paving at $40,000.

Woodward, Ia.—Church Building—W. A. Drennan, Des Moines, new Methodist Church building.

Humboldt, Ia.—Library Building—Mayer Bros., Humboldt, Ia.

Springfield, Mass.—Electric Light Plant—The Aberthaw Construction Co., 8 Beacon St., Boston, addition for United Electric Light Co.

Rutherford (Harrisburg P. O.), Pa.—Light, Heat and Power Plant. Augustus Wildman, Harrisburg.

Aliquippa, Pa.—Steam Pipe System—The Pittsburg Valve, Foundry & Construction Co., Pittsburg. for power house of Jones & Laughlin Steel Co.

Gadsen, Ala.—Producing Furnaces—The Laclede Fire Brick Co., St. Louis, Mo., for the Tri-City Gas Co., at about $10,000.

Langdale, Ala.—Water-wheels, Etc.—The Globe Iron Works Co., Dayton, O., for the power plant of the West Point Mfg. Co., West Point, Ga., and The Westinghouse Electric & Mfg. Co., Pittsburg., for electrical machinery.

Biloxi, Miss.—Electric Lighting—The Gulfport & Mississippi Traction Co., to light city with electricity for 10 years.

Fayetteville, Tenn.—Concrete Dam—The Nashville Concrete Co., Nashville, across Elk River at $7,000.

Tecumseh, Neb.—Electric Light Plant—Buckeye Engine Co., Salem, O., Westinghouse Electric & Mfg. Co., Pittsburg, Pa., English Iron Works, Kansas City, Mo., Western Electric Co., Kansas City, Mo. Total cost $16,000.

Billings, Mont.—Power Plant—The Iowa Construction Co., Oskaloosa, Ia., for the Billings Heating Co., at $67,400.

Battleford, Sask.—Electric Power Plant—The James Stuart Electric Co., Winnipeg, Manitoba.

Millbury, Mass.—Bridge—The Berlin Construction Co., across Blackstone River at South Main St.

Lenoir City, Tenn.—Concrete Bridge—Moreland & Moses, Knoxville, arch across Town Creek.

Fond Du Lac, Wis.—Bridge—Scoris Bros., Milwaukee, bridge at Johnson St.

Luverne, Minn.—Bridge—P. N. Gillham, bridge across Rock River at $3,430.

Pateros, Wash.—Bridge—J. W. Quigg, 250 ft. steel bridge across Methow River at $13,754.

Oroville, Cal.—Bridge—Pacific Construction Co., city's span of Feather River bridge at $6,500.

Ft. William, Ont.—Bridge—Wiley & Belfour, Ft. William, bridge substructure at about $150,000.

New York, N. Y.—Building—Mare Edlitz & Son, 489 Fifth Ave., 7 story club building at about $300,000.

New York, N. Y.—Bank Building—John Peirce Co., Lenox Ave. and 45th St., New York, at $125,000.

Albany, N. Y.—Buildings—A. E. Stevens, Binghamton, construction of N. Y. State Normal College.

Negaunee, Mich.—School Buildings—L. E. Chausee, Negausee, new high school.

North Chicago, Ill.—Buildings—The Northern Construction Co., Milwaukee, Wis., 12 buildings at the naval training station at $370,000.

Fort Smith, Ark.—Building—The Manhattan Construction Co., New York, 6 story concrete hotel building at $160,000.

San Francisco, Cal.—Building—The Thompson-Starrett Co., 2053 Sutter St., San Francisco, 3-story building for D. Samuels Lace House Co. at $300,000.

Pawtucket, R. I.—Water Supply—Wilmarth & McKillop, Pawtucket, pumping station for water works at $42,120.

Auburn, N. Y.—Water Supply—The Trump Mfg. Co., for constructing water wheels at $4,500.

Vienna, Ga.—Water Supply—Walton & Wagner, Atlanta, construction of water works at $16,100.

Fond Du Lac, Wis.—Water Supply—S. H. Cole, for constructing gravity intake water works system at $20,000.

Coleraine, Minn.—Water Supply—A. G. Osman, Duluth, water works and sewerage system at $130,000.

Bonesteel, S. D.—Water Supply—C. E. Haakinson, Sioux City, Ia., constructing water works at $16,000.

Brownsville, Tex.—Water Supply—The American Light & Water Co., for municipal water works and electric light systems at $65,940.

Tacoma, Wash.—Water Supply—B. W. Kibler, laying water mains at $28,730.

San Diego, Cal.—Water Supply—Robt. Sherer & Co., Los Angeles, improvement of water works system at $150,000.

PROJECTED WORK.

Railroads.

Items Arranged Alphabetically by States.

Pine Bluff, Ark.—Thomas A. Bell Construction Co., Kansas City, Mo., is making surveys for determining roadbed of Pine Bluff North & South R. R.

Crowley, Ala.—Alabama, Florida & Gulf R. R. has been incorporated, and proposes to build a line from this place to Chipley, Fla., 120 miles. Several lumber companies, among which is the Alabama & Florida Lumber Co., are interested.

San Diego, Cal.—Actual construction work is to be begun soon on the San Diego & Arizona R. R., from this city to the Imperial Valley, Yuma, Ariz. The first grading contract has been let to Rendall, Frazier & Co., San Diego, and other contracts are to be let as fast as right of way can be secured.

Byers, Ind. T.—It is announced that Chicago, Rock Island & Pacific R. R. will build an extension from Waurika to Byers, connecting with the branch now in operation between that place and Wichita Falls, Tex.

Sulphur, Ind. Ter.—Surveys for the Sulphur, Coalgate & South Eastern Ry., chartered to be built from this place eastward to Paris, Tex., have been completed through the lands of Chicasaw Nation. It is thought the road is to be an eastern extension of A. T. & S. Fe.

Topeka, Kan.—Preparations are now being made at Chicago headquarters of Chicago, Rock Island & Pacific R. R. to let the grading contract for the proposed double track between Topeka and McFarland. The work will be divided into two divisions: Topeka to Maple Hill, and Maple Hill to McFarland. The contract for grading the first division will be let, it is said, within two weeks.

Lincoln, Neb.—According to reports from this city incorporation papers are to be taken out here for a railroad to extend from the northern part of Nebraska to the Gulf of Mexico. The report states that the necessary capital for construction of the road is practically assured. Edw. T. Roemer, C. E., 177 E. 93d St., New York City, is said to be interested.

Buffalo, N. Y.—Good progress is being made with surveys for Buffalo, Rochester & Eastern R. R., which is to run from Buffalo to Troy, and it is probable that a hearing on the proposed route will be held this month before the Public Utilities Commission. Officers of the road are: R. D. Gillett, President, and Archie D. Robinson, Secretary.

Oklahoma City, Okla.—McAlester Southern Ry. Co., capitalized at $5,000,000, has been granted charter in Indian Territory. It proposes to build a road 250 miles long from Sallisaw, in the Chickasaw Nation, in a southwesterly direction to McAlester; thence southwest to east boundary line of Comanche County and thence southeast to point in Red River in above county. C. W. Dawley, McAlester, Ind. Ter., and J. N. Graves, Oklahoma City, are interested.

Beaumont, Tex.—Advices from this place state that the Atchison, Topeka & Santa Fe R. R. is to connect up its Beaumont properties with Houston. To do this a cutoff is to be at once constructed from Stowell through Anahuac and Wallisville to Houston.

Dallas, Tex.—The first construction contracts are to be let shortly, it is said, for the Peoples' Ry., which proposes to build a line from Dallas to Leesville, La. J. M. Howe, Tyler, Tex., is Chief Engineer.

Fairmont, W. Va.—Fairmont Southern R. R. Co. has been chartered and proposes to construct a railroad from Bellington, W. Va., to Pittsburg, Pa., 225 miles. Among those interested are Benjamin F. Overholt, Scottdale, Pa.; Chas. F. Winters, Phillippi, W. Va., and W. H. Conaway, Fairmont.

Electric Railroads.

Items Arranged Alphabetically by States.

Quitman, Ga.—The Quitman, Valdosta & Thomasville Railway & Power Co. has been chartered to build an electric railway from Quitman to Valdosta and Thomasville, 45 miles. Grading has been commenced from Quitman east.

Davenport, Ia.—Preliminary surveys have been started for the projected Davenport-Manchester interurban line. W. H. Kimball Engineering Co. are the Engineers.

Fort Madison, Ia.—Work on grading for the electric railway of the Mississippi Valley Electric Co. has already been started and it is hoped to have the grading of the entire line completed by December. T. E. Luttgerding, Eldorado, Kans., is the contractor.

Peoria, Ill.—Peoria Ry. Co., S. L. Nelson, Manager, proposes to rebuild its car lines on Adam St. and Main St.

Marengo, Ill.—C. A. Spenny and E. B. Harring, Columbus, O., are reported to be promoting a project for constructing electric railway between this place and Sycamore.

Gary, Ind.—The street railway franchise recently granted here is stated to have been transferred to the Chicago & New York Air Line Co. Press reports quote J. D. Price, Indianapolis, and president of the construction company allied with the Air Line Co., as stating the company planned to build the Gary and Interurban line withing the next six months.

Parsons, Kan.—A company has been organized to take over the interurban projects promoted by Robert G. Rawlings, Chanute, Kan. It is proposed to build a system of interurban lines connecting Parsons, Cherryvale, Coffeyville, Independence and Chanute. Construction work, it is said, will be started at once at Parsons. Wm. B. Henderson, Kemper Bldg., Kansas City, Mo., is interested.

Hubbard, Mo.—The St. Joseph, Excelsior Springs & Lexington Ry. Co., has been incorporated and proposes an electric railway from Excelsior Springs to Hubbard, six miles. Dr. G. P. Lingenfelter, Denver, Colo., and David C. Finley, N. Y. Life Bldg., Kansas City, Mo., are among those interested.

St. Joseph, Mo.—Final surveys are practically completed for the proposed interurban line of the St. Joseph & Nodaway Valley Ry., and it is expected that construction contracts will be let shortly. Ira Williams, Savannah, Mo., is president.

Bemidji, Minn.—Route for street railway which is to be built here has been selected. C. C. Gowran, Grand Forks, N. Dak., and Fred Fulton, Chicago, Ill., are interested.

Princeton, Ind.—Blueprints have been prepared of the proposed extension of the Trenton, Lawrenceville & Princeton R. R., from Princeton to Somerville. It is probable that the line will be extended from Somerville to Mendham and Morristown, with a possible branch to Lake Hopatcong.

Buffalo, N. Y.—The Crosstown Street Railway Co., will extend its line half a mile from easterly limits of Buffalo to Pine Hill Road.

Mercer, Pa.—It is expected that work will be started shortly on the construction of a new trolley line between this place and Greenville. The Mercer Construction Co., recently incorporated by T. P. Filer, of Mercer, Sylvester Downs of Greenville, and others, will do the work.

Newcastle, Pa.—B. E. Cutler, Grove City, Pa., is promoting a project for the construction of an electric line from Newcastle to Franklin, 51 miles.

Asheville, N. C.—Surveys have been completed, right of way secured and sufficient capital obtained, it is said, to assume the building of the electric line of the Asheville & Hendersonville R. R. Co. The road will be 20 miles long, and estimated cost of entire work is set at $300,000. C. E. Van Bibber, New York City., will superintend the construction work.

Electric and Gas Plants.

Items Arranged Alphabetically by States.

Montezuma, Colo.—Montezuma Power & Light Co., capitalized at $50,000, has been incorporated by Geo. L. Nye., B. P. Morrison and H. W. Wagner.

Hartford, Conn.—An addition will be built to power house of Hartford Electric Light Co.

Decatur, Ala.—Inprovements costing about $75,000 will be made to plant of Decatur Light, Power & Fuel Co.

Davenport, Ia.—Independent Power & Light Co., Davenport, will erect a power station.

Chandlersville, Ill.—Franchise for installation of electric plant in this place has been granted to F. P. Schaaf.

Marlboro, Mass.—Plant of Marlboro Electric Co., is to be improved at cost of about $170,000, it is stated.

Eldorado, Mo.—Plant of Eldorado Springs Electric Light & Power Co., recently damaged by fire, will be rebuilt.

Moberly, Mo.—Wabash R. R. will install electric light plant at its shops in this city.

Savannah, Ga.—Installation of electric light plant at municipal waterworks station is said to be under consideration.

Fargo, N. Dak.—Plans have been prepared for enlargement of power plant of Union Light, Heat & Power Co. Estimated cost is $30,000.

Omaha, Neb.—Special election may be called to vote on issuing $1,500,000 of bonds for construction of a municipal gas plant.

Bethlehem, N. H.—Controlling interest in Bethlehem Electric Light Co. has been purchased by Dr. G. H. Morrison, Whitefield, N. H.

Canajoharie, N. Y.—Montgomery Electric Light & Power Co. will erect a new substation on West Main St.

Larchmont, N. Y.—The Larchmont Yacht Club will soon install its own electric light plant.

Fort Worth, Tex.—Northern Texas Traction Co. will enlarge its power house at Handley. About $150,000 will be expended for equipment and improvements.

Elkins, W. Va.—The Elkins Electric Ry. Co. is considering a project for securing power from the Cheat River by building a 12-mile pipe line.

Sewers.

Items Arranged Alphabetically by States.

Paragould, Ark.—Sewer system to cost $40,000 is to be installed for this city. W. K. Palmer Co., Kansas City, Mo., are the engineers.

Alamosa, Colo.—Plans are being drawn for sewer system for this place.

Charlton, Ia.—Several new sewers are proposed.

Marshalltown, Ia.—A 12-mile sewer costing $2,000 is to be constructed.

Parkersburg, Ia.—Council has ordered construction of 18-in. sewer. W. T. Evans, Clerk.

Wapello, Ia.—Sewers to cost $6,500 are proposed. E. F. Christie, City Recorder.

Decatur, Ill.—Board Local Improvements has instructed City Attorney to draw ordinances for construction of branch sewers to cost about $11,000.

Elgin, Ill.—Board Public Improvements contemplates construction of storm and sanitary sewer system for Sixth ward.

Joliet, Ill.—Board Local Improvements has adopted resolutions calling for construction of sewers in First ward to cost $31,000.

Springfield, Ill.—Bids are to be asked at once for construction two main sewers in southeast section of city. Estimated cost is $40,000.

South Bend, Ind.—Board Public Work will call for bids for sewers in Notre Dame Ave. and Cherry St.

Wellington, Kan.—Plans are being drawn for sewer system for this place. H. A. Rowland is Engineer.

St. Louis, Mo.—Board Public Improvements is still working on plans for building a sewer through Forest Park hill to carry the River des Peres. The cost of the improvement would be nearly $10,000,000.

Allegheny, Pa.—Plans are to be prepared for sewer plant at City Home.

Carlisle, Pa.—Town Council has approved plans of John Hutton, Engineer, Philadelphia, Pa., for sewer system for this place. Estimated cost is $189,000.

Marlin, Tex.—Houston & Texas Central R. R., is to construct cement sewer from Coleman to Live Oak St.

Sherman, Tex.—Extension of city sewer system to Austin College is under consideration.

Water Supply.

Items Arranged Alphabetically by States.

Monterey, Cal.—Monterey, County Water Co., San Francisco, has been incorporated with capital of $2,000,000. Chas. E. Green is interested.

Johnstown, Colo.—City is considering constructing waterworks to cost $20,000.

Concordia, Kan.—Burns & McDonnell, Engineers, Kansas City, Mo., are preparing plans for remodeling local waterworks.

Shelley, Idaho.—Waterworks to cost $6,500 are to be installed by city.

Lindsay, Ind. Ter.—City has voted $25,000 by bonds for installing waterworks.

Franklin, Neb.—Bond issue for installing waterworks has been voted.

Casselton, N. Dak.—C. A. Hopeman, Moorhead, Minn., is engineer for projected waterworks and sewerage for this place.

Washington, N. J.—Two miles of mains are to be laid and storage reservoir built by Washington Water Co.

Dunkirk, N. Y.—Water Board has voted to build addition city water and electric light plant.

Peekskill, N. Y.—State Legislature has authorized city to construct waterworks at a cost of $200,000.

Fishkill, N. Y.—Franchise for installing waterworks here has been granted to Brown & Freeman, New York City.

Mangum, Okla.—$60,000 of bonds have been voted for additional improvements to waterworks, sewers and streets.

Capital Hill, Okla.—Bond issue for $85,000 for waterworks and sewers has been authorized by City Council.

Granite, Okla.—Construction of waterworks here is under consideration.

Bay City, Tex.—City is considering installing waterworks. Estimated cost, $18,000.

Temple, Tex.—Election is to be held Oct. 2 to vote on issuing $90,000 of bonds for extending waterworks.

Manitowoc, Wis.—Special election is to be held Sept. 24 to vote on purchasing local water works.

Medford, Wis.—C. H. Phillips, Marshfield, Wis., has prepared estimate for waterworks for this place to cost $30,000. Special election will be called soon to vote on issuing bonds.

Thermopolis, Wyo.—Waterworks to cost about $50,000 are to be constructed for this city. J. B. Chessington is Engineer.

BIDS ON STREET PAVING.

Dallas, Texas, August 30, 1907.

Sealed bids or proposals will be received at the office of the City Secretary until 3 o'clock p. m., Friday, September 20, 1907, for the paving of Ross Avenue and Main Street, with one of the following materials:

(a) Bitulithic Pavement, with concrete base, Bitulithic pavement with bituminous base.

(b) Sheet Asphalt.

(c) Natural Rock Asphalt.

(d) Indian Territory Rock Asphalt.

(f) Asphalt with binder course. The base of said asphalt pavements herein named shall be concrete base.

(g) Bituminous material on concrete base.

(h) Creosote Pine Blocks on concrete base.

(i) Bois D'Arc Blocks on concrete base.

(j) Bermudez Asphalt, concrete base.

(k) Vitrified Brick pavement on concrete foundation.

(l) Limestone curb.

(m) Limestone gutter.

(n) Combination Concrete gutter and curb.

(o) Concrete curb.

(p) Concrete gutter.

(q) Concrete gutter and limestone curb.

(r) Brick gutters.

The City reserves the right to reject any or all bids. A certified check of $2,000 must accompany bid on Main street, and certified check for $2,500 must accompany bid on Ross Avenue. Specifications for above work on file in the office of the City Secretary, Dallas, Tex.

J. B. WINSLETT,
11-1t. City Secretary.

BRICK PAVING.

Quincy, Ill., Sept. 6, 1907.

Sealed proposals will be received by the Board of Local Improvements until 2 o'clock p. m., Wednesday, September 18, 1907, for constructing brick pavement on 10th street, between Oak street and Sycamore street, 6 in. broken stone base, 3 in. sand cushion, single course of brick.

14,230 sq. yds. of paving, 6,821 lin. ft. of sand stone curbing, 6,688 cu. yds. of excavation. Certified check 10 per cent.

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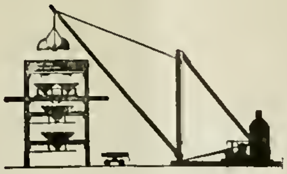
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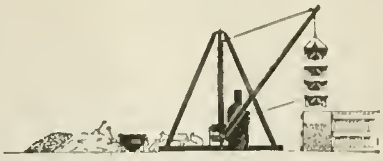
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LAKE VIEW PUMPING STATION DEPARTMENT OF PUBLIC WORKS.

CHICAGO, August 30, 1907.

Sealed proposals will be received by the city of Chicago until 11 a. m. Friday, September 13, 1907, at room 224, city hall, for the furnishing of all materials, tools, labor, machinery, and appliances of whatsoever kind or description necessary to construct the superstructure of an engine house, together with foundation and superstructure for a connecting building, at the Lake View pumping station, located at the northeast corner of Montrose boulevard and Clarendon avenue, in the city of Chicago, according to plans and specifications on file in the office of the Department of Public Works of said city, room 325, city hall.

Proposals must be made out upon blanks furnished at said office, and be addressed to said department, indorsed "Proposals for Lake View Engine House," and be accompanied with five thousand dollars in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago and made payable to the order of the commissioner of public works

The commissioner of public works reserves the right to reject any or all bids.

A deposit of $5.00 will be required to insure the safe return of plans and specifications.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the commissioner of public works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names as well as the name of the firm with their address.

JOHN J. HANBERG.
Commissioner of Public Works.
By PAUL REDIESKE,
Deputy Commissioner.

10-2t

SEWERAGE SYSTEM.

Township of South Orange, N. J.

Sealed proposals will be received by the Township Committee of the Township of South Orange, at their rooms in Maplewood, N. J., until 8 o'clock p. m., Tuesday, September 17, 1907, for the construction of sanitary sewers in two sections of the Township and requiring quantities approximately as follows:

Maplewood District—
- 3,460 feet of 10-inch vitrified pipe sewer.
- 15,090 feet of 8-inch vitrified pipe sewer.
- 63 manholes.
- 12 flush tanks.

South Orange Heights District—
- 250 feet of 10-inch vitrified pipe sewer.
- 16,648 feet of 8-inch vitrified pipe sewer.
- 47 manholes.
- 13 flush tanks.

Proposals for each district must be made separately and each accompanied by a certified check for $2,000, made payable to the "Township of South Orange." Plans and specifications can be seen at the Public Building, Maplewood, N. J., and at the office of Alexander Potter, Consulting Engineer, 143 Liberty St., New York City.

The right is reserved to reject any or all bids.

By order of the Township Committee.

EDWARD R ARCULARIUS,
Township Clerk.
ALEXANDER POTTER,
Consulting Engineer.

10-2t

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WANTED—Name and address of New York party who on Aug. 31 sent us typewritten postal card requesting catalogs on various subjects but omitted to sign his name or give any clue as to identity or address. Engineering-Contracting, 355 Dearborn St., Chicago.

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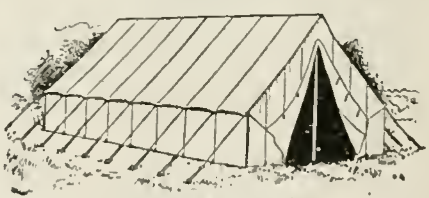

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No. 1 Smith mixer, engine and boiler, on wheels	625
No. 0 Smith mixer, engine and boiler, on wheels	525
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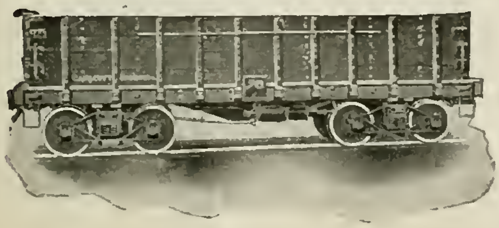

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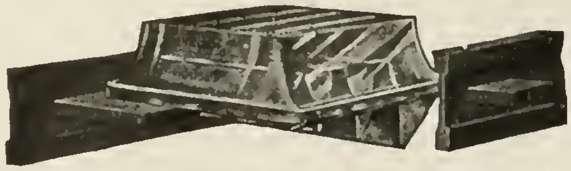

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Another Example of Inefficient Day Labor on Government Work—A Reinforced Concrete Pipe in Arizona.

The United States Reclamation Service is doing a very large amount of construction work by day labor, and the work is proving no exception to the general rule that it costs a government far more than it costs a contractor to build a structure. The Reclamation Service has probably felt that it has been forced to do much of its work by day labor rather than by contract, either because of the high prices bid or because no bids at all have been received. In no unfriendly spirit, therefore, do we call attention to the extremely high cost of a reinforced concrete pipe built in Arizona by the forces of the Reclamation Service. But when labor alone costs $5.98 per cu. yd. of such work, it is time that the Reclamation Service should make more vigorous efforts to secure bids from contractors.

We believe that the Reclamation Service has failed to receive bids on some of its work for the following reasons:

First, because it is "Government work." Due to the one-sidedness and ambiguity of many specifications drawn by the army engineers, followed by severe and often unreasonable interpretation of the specifications, contractors have become very chary about bidding on a "government job." Many contractors do not know that the Reclamation Service is an entirely different branch of the government, and look upon it with unfavorable eyes, due to their former unfortunate experiences under the army engineers.

Second, because the specifications of the Reclamation Service are themselves far from being as clear and reasonable in their requirements as they should be. And this is so in spite of an honest effort on the part of the Reclamation Service to do what is right.

Third, because the time requirements have been too inelastic. This is a matter of serious moment in the far west, where practically all the Reclamation Service construction is under way, for in that section it is not only extremely hard to secure a big force of men and to hold them, but it is equally difficult to secure any plant or materials that must be shipped long distances by rail. Contractors have felt the pinch of "car shortage" so many times in their recent dealings with western railways that they refuse to be bound by iron-clad time limit clauses which place all the burden of risk upon the contractor, regardless of whether the fault is his or is that of the railways.

Fourth, because many of the engineers' estimates of cost, as made by the Reclamation Service, are unreasonably low. The Service seems to have failed to give contractors the credit of knowing what a fair price is, or of being honest in their competition for work. When an engineer's estimate is greatly exceeded by the bids, he usually claims either that the contractors do not know their business, or that they have combined to stifle competition. Sometimes the engineer is right, but rarely so.

On the other hand, the Service has accepted several bids which were obviously too low, and have subsequently been forced to take the work out of the contractor's hands. This very action on the part of the Service has received wide publicity—the Service itself apparently seeking to cry the fact from the columns of all the daily papers—with the result that contractors have become more than ever cautious about bidding on "government work."

Fifth, the service has received few or no bids on some projects because of the failure to advertise and describe the project in sufficient detail. The Service could well afford to print a pamphlet describing all local conditions in detail, accompanied by photographs, and the engineer's detailed estimate of the cost of the work. This pamphlet should be illustrated by photographs and drawings, and should be advertised extensively. The projects are usually of a sufficient size to warrant a liberal expenditure to secure a publicity that will attract contractors. The Service would do well, also, to make the contractors feel that sub-contracts are not objectionable, and thus attract the large railway contractors who are in the habit of subletting a great part of their work in small sections. Indeed, if necessary, let the Service divide its large projects into numerous small sections, and appeal directly to the small contractor.

There is surely some way of getting bidders to bid in sufficient numbers to secure reasonable prices. The Service is to our mind making a serious mistake in not exerting itself to the utmost to get away from the day labor system which seems to have been forced upon it by circumstances. We know that it is often a great temptation to engineers to attack a big piece of work with forces under their own personal direction. They often feel that in this way they are training themselves to go into the contracting business later on. They always feel that they are of more importance in the eyes of the world if they are builders as well as designers.

An engineer who does his duty by his client, when that client is a municipality, a state, or a nation, will resolutely put aside the temptation to acquire experience at his client's expense. He will never attempt to perform any sort of work by the wasteful day labor system, if it can possibly be done by contract.

One of the longest railway tunnels in the world is to be constructed under Arthur's Pass on the line of the Midland Ry. in Australia. According to specifications the tunnel will be 17 ft. high and 15 ft. wide, and will be lined throughout; its length will be 28,052 ft. long, or 332 ft. over 5¼ miles. The material penetrated will be rock which, according to the English newspapers, is expected to develop considerable value. The contract for the work is held by J. McLean & Son at £599,794, or about $2,998,000. The work is expected to be completed in about five years.

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Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Methods and Cost of Constructing a Reinforced Concrete Pipe for Carrying Water Under Pressure.*

BY CHESTER WASSON SMITH, ASSOC. M. AM. SOC. C. E.

(Continued from Sept. 11 issue.)

The figures in Table I, as to the cost of two sections of the second Pinto pipe, show the labor cost only, and do not include engineering, first cost of forms, cement, reinforcement, or grading.

A gang consisted of a foreman at $175 per month, a sub-foreman at $3.50 per day, and the following laborers at $2.50 per day: one bending the reinforcement rings; two placing the reinforcement; four taking down, moving and erecting the stationary plates; four placing the concrete and outside lagging; two wheeling concrete; six mixing concrete; one wheeling sand and gravel; one watering the finished pipe; four laying track for the steering apparatus, moving the superstructure and hangers, mixing boards, runways, etc.; one pointing and finishing inside the pipe; and one on the whim and doing miscellaneous work. The labor was principally Mexican, and only fairly efficient.

TABLE I—LABOR COSTS ON SECOND PINTO PIPE.

		Wages per day.	May, 1906. 714 lin. ft. Cost.	July, 1906. 1009 lin. ft. Cost.	Cost per lin. ft.
4 men	Laying track for steering alligator	$ 5.00	$ 71.48	$ 43.98	$0.0670
	Moving and erecting superstructure	5.00	299.94	358.44	0.3821
4 men	Moving plates	10.00	202.50	253.44	0.2646
	Repairs to alligator	....	58.50	2.50	0.0354
1 man	Bending rings	2.50	32.87	59.87	0.0538
2 men	Placing reinforcement	5.00	126.94	138.13	0.1538
12 men	Mixing and placing concrete	30.00	709.68	949.74	0.9631
1 man	Watering finished pipe	2.50	45.00	78.27	0.0716
1 man	Painting and brush-coating inside	2.50	96.50	117.37	0.1241
	Blacksmith's work	......	30.00	25.00	0.0319
1 man	Whim	2.50	23.87	28.75	0.0306
1 man	Screening and hauling sand and gravel	2.50	183.13	300.00	0.2804
	Total		$1880.41	$2355.49	$2.4584

RESULTS OF LEAKAGE TESTS.

The leakage in the pipes was measured by observing the water level in them, all water being shut off. The head mentioned in the tables is the elevation of the water level above the lowest point in the pipe.

The periods are consecutive in each case, that is, on January 25th the periods were during 2 consecutive hours, and on January 26th, during 6 consecutive hours, etc.

From February 26 to March 15 the pipe was in use a large part of the time. Various longitudinal cracks developed from time to time and were repaired. The next opportunity to measure leakage was from March 15 to 22, after all the cracks had been repaired, since which time no more have appeared.

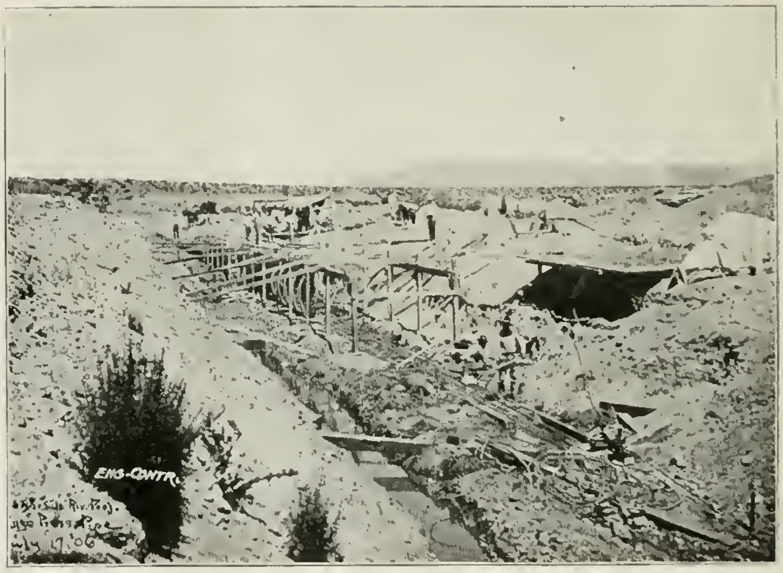
During the construction of the south line of the Pinto pipe, one lot of inferior cement, containing free lime, was received on the work, and a portion of it was used before being discovered. The result was a slower setting concrete, and at several places the upper stationary plates were removed too soon, allowing the concrete inside the reinforcement to settle and part from the outside.

Of these places, the worst one was repaired before the test of December 14 was made, but several minor ones, as well as most of the transverse joints, were not repaired until after that test

CONCLUSIONS.

The very slow setting cement used on this work rendered it impracticable to work continuously on account of the excessive number of stationary plates which would have been required.

With a cement setting in average time, the continuous process would certainly be practicable and advisable; and a machine similar to the one described herein, or designed to accomplish similar results, would probably be the best solution of the question of forms.



The Construction of the Pinto Pressure Pipe.

The necessity of continuous work may be said to vary with the temperature at which the pipe is constructed; at low temperatures it would be almost a matter of indifference; even at high temperatures it is probable that continuous work would not be absolutely necessary, because a method of making connections which would result in a nearly water-proof joint could probably be devised.

There are many engineering works, in process of construction, or projected, for conveying water under pressure, where similar reinforced concrete pipe could be used, and would be, were engineers satisfied as to its first cost, durability and reliability.

The question may be asked, what is the maximum head for which this kind of construction could be used? The precedent for such construction, as well as the literature on the subject, are both believed to be quite meager, though the writer has had little opportunity for searching engineering literature. Attention might be called to a paper* by J. H. Quinton, M. Am. Soc. C. E., entitled "Experiments on Steel Concrete Pipes on a Working Scale."

---

*A paper read before the American Society of Civil Engineers and printed in the Proceedings for August, 1907.

The excessive amounts of leakage reported in that paper would seem to have been due to the use of a dry mixture, and the writer would take decided exception to the conclusion (expressed on page 55), that "reliance for impermeability must be placed on the plastering rather than on the material of the pipe." Reliance should be placed upon a wet mixture of the material of the pipe.

There is no doubt that the first cost would be less than for either cast-iron or riveted-steel pipe, and would be little if any in excess of wood-stave pipe.

As regards durability, the question is as to the relative durability of the metal in the various kinds of pipe, disregarding for the moment the life of the wood staves.

The reinforced concrete pipe should be far less likely to be destroyed by electrolytic action than either cast-iron or steel pipe. The reinforcement receives a coating of cement which stays with it when the surrounding concrete is cracked or broken away, and the question becomes one of the relative efficacy of the cement coating on one hand, and the asphalt coating of the metal pipe on the other, remembering that the cement coating is absolutely protected against abrasion, and also enclosed in a manner which renders inspection difficult and incomplete.

It may be observed here that the metal in the reinforced concrete pipe possesses the same advantage over the metal in the riveted-steel pipe which has been advanced in favor of the bands on wood-stave pipe; *i. e.*, of form, being a rod with a diameter considerably greater than the thickness of the riveted-steel pipe. In other words, given a certain quantity of steel per linear foot of pipe (enough to carry the load), the most durable form would be that with the least amount of exposed surface.

The problem of inspection might be solved by cutting into the steel occasionally at suspected points, such as at some crack or leak. The reinforcement in the concrete pipe should have a much longer life than the bands on the wood-stave pipe, though, on the other hand, the latter can be readily inspected and renewed.

TABLE II.—LEAKAGE TESTS PINTO PRESSURE PIPE NORTH LINE.

(This pipe was built between June and November, 1905, and first filled with water on January 25, 1906.)

Date.	Duration of test. Hours.	Minutes.	Leakage in gallons.	Gallons per hour.	Average head
Jan. 25, 1906...	0	30	1,225	2,450	30.2 to 26.5
" 25, 1906....	0	30	1,225	2,450	
" 25, 1906....	0	30	1,130	2,260	
" 25, 1906....	0	30	992	1,984	
Jan. 26, 1906....	1	00	..	2,205	30.5 to 22.4
" 26, 1906.....	1	00	...	1,960	
" 26, 1906.....	1	00		1,837	
" 26, 1906.....	1	00		1,592	
" 26, 1906.. .	1	00	.	1,102	
" 26, 1906... .	1	00	.	1,225	
(The pipe was full of water from January 26th to February 17th.)					
Feb. 17, 1906..	1	00	.....	300	21.5
Feb. 22, 1906..	1	00	..	183	27.9
(On February 26th a longitudinal crack, 40 ft. long, developed.)					
Feb. 26, 1906..	1	15	7,035	5,628	26.0 to 20.2
" 26, 1906..	12	15	4,490	367	20.2 to 16.5
" 26, 1906 .	1	00	.	86	16.5
(This test shows the effect of a crack, and the effect of a small reduction of head.)					
Mar. 15, 1906, 8:15 A. M., to Mar. 22, 1906, 6:30 A. M.	2	30	375	150	26.9
	7	00	350	50	26.6
	14	30	1,650	114	26.3
	4	15	475	112	25.9
	5	00	420	84	25.6
	16	45	1,575	94	24.7
	6	45	460	68	23.9
	19	00	1,740	92	23.0
	6	15	375	60	22.1
	13	30	1,610	119	21.3
	11	30	715	62	20.4
	11	15	1,100	98	19.6
	13	00	730	56	18.9
	13	30	730	54	18.3
	11	00	460	42	17.8
	10	30	375	36	17.4
Dec. 19, 1906.	16	00	9,893	618	30.5 to 20.9
	1	00		550	
	1	00		458	
	1	00		458	
	1	00		458	
Jan. 30-31, 1907	24	00	92	3.8	30.5
(This test shows the effect of a run of muddy water.)					

Of course, as to the relative permanence of wood and concrete, there can be no question, even admitting the claims of the most ardent wood-stave advocates.

The reliability, or safety against sudden failure under a high pressure, seems to the writer to be simply a matter of correct design (to be determined, doubtless, by experiment), and the character of the inspection of the materials and construction. It is not necessary to state that the inspection should be absolutely first class. It would seem that in correct design the relative quantities of concrete and steel should be such that the concrete in shrinking cannot compress the steel, but will crack; then, with nearly perfect adhesion of the two, there should be many cracks, but so minute that they will readily silt up.

Whether the concrete cracked at few places or many would depend upon the quality of the concrete, the relative quantities of concrete and steel, and the degree of perfection of the adhesion. In this there is a field for experiment, in order to determine the strength of adhesion of concrete and steel, the best form of reinforcing rod, and the amount of shrinkage during the setting of various mixtures of concrete.

It will undoubtedly be found that there is a minimum advisable spacing for the re-

TABLE III.—LEAKAGE TESTS PINTO PRESSURE PIPE SOUTH LINE.

(Built March to August, 1906, and first filled on December 15, 1906.)

Date.	Duration of test. Hours.	Minutes.	Leakage in gallons.	Gallons per hour.	Average head.
Dec. 15, 1906	1	00	18,320	18,320	30.5 to 15.5
	1	00	3,664	3,664	15.5 to 12.5
	1	00	489	489	12.5 to 11.6
	1	00	366	366	
	1	00	290	290	
Jan. 26, 1907	2	00	3,191	1,595	30.5 to 27.9
	2	00	3,100	1,550	27.9 to 25.4
	12	00	13,648	1,137	25.4 to 14.2
	2	00	641	320	14.2 to 13.7
Jan. 29-30, 1907	1	00	2,198	2,198	30.5 to 28.7
	1	00	2,107	2,107	28.7 to 27.0
	1	00	1,832	1,832	27.0 to 25.5
	1	00	1,832	1,832	25.5 to 24.0
	1	00	1,649	1,649	24.0 to 22.7
	1	00	1,465	1,465	22.7 to 21.5
	18	00	9,984	555	21.5 to 13.3

---

*Water Supply and Irrigation Paper No. 143 of the United States Geological Survey.

inforcing rings, on account of their tendency to form a plane of cleavage and thus separate the concrete into an inner and an outer shell; also to insure the complete filling of the entire space with the concrete. For a large quantity of steel in the section, the arrangement might be in the form of two or more rows of rings staggered.

This paper is presented, not as pretending to solve the problem, but with the hope that the governing conditions have been stated correctly, and that the suggestions will be of some value.

In conclusion, the writer wishes to acknowledge valuable assistance derived, during the construction of the pipe and the repair of the cracks, from a free discussion of the various problems with Louis C. Hill, M. Am. Soc. C. E., Supervising Engineer; F. Teichman, M. Am. Soc. C. E., Designing Engineer, and Mr. A. L. Harris, Assistant Engineer; also the exceptionally conscientious work of Mr. A. P. Cox, Foreman.

TABLE IV.—LEAKAGE TESTS COTTOWOOD PRESSURE PIPE SOUTH LINE.*

(Built between December 25, 1905, and January 26, 1906, and first filled on March 9, 1906.)

Date.	Duration of test.		Leakage in gallons.	Gallons per hour.	Average head.
	Hours.	Minutes.			
Mar. 9, 1906	0	30	535	1,070	38.4 to 34 3
" 9, 1906	2	30	1,452	580	
" 9, 1906	1	00	...	473	
" 9, 1906	1	00	..	443	
" 9, 1906	1	00	...	370	
Mar. 10, 1906	0	30	1,475	2,950	49 0
Mar. 27, 1906	2	30	38,100	15,200	74 to 18.
Sept. 22, 1906	7	00	0	0	74

*The south line was the first one constructed at Cottonwood. Some time in April the pipe failed by blowing out a hole about 4 ft. square in its top. This was at the point where the first roof plates were removed, and would indicate that they were removed too soon, allowing the concrete inside the reinforcement to settle a little and part from the reinforcement and the outside concrete. The hole was cut out to solid work, and patched.

TABLE V.—LEAKAGE TESTS COTTONWOOD PIPE NORTH LINE.

(Built January 8 to 20, and first filled on March 9, 1906.)

Date.	Duration of test.		Leakage in gallons.	Gallons per hour.	Average head.
	Hours.	Minutes.			
Mar. 9, 1906	0 2 1 1 1	40 30 00 00 00	167 591	251 237 177 121 98	24 0 to 22.5
Mar. 10, 1906	0 2	30 30	3,540 12,500	7,080 5,000	69.0 60.0
	(8-ft. longitudinal crack opened.)				
Mar. 23, 1906	2 0	15 30	4,525 1,048	2,010 2,097	60 73
Mar. 27, 1906	2	20	9,000	3,860	74.0 to 60.7
Mar. 28, 1906	5	45		1,170	73 to 63
Mar. 29, 1906	18	45		800	58
April 16-17, 1906	26	00		39	74
May 24-26, 1906	55	00	863	16	74
May 28-29, 1906	48	00	000	000	74
Sept. 22, 1906	24	00	000	000	74

Between March 10th and 27th various short longitudinal cracks developed and were repaired. The pipe was in service intermittently. Since the end of March the pipe has been almost constantly in service.

The city of St. Louis, Mo., has spent over $2,000,000 for bridges over Mill Creek Valley and grade abolishment.

Work has been commenced on the southern extension of the power lines of the California-Nevada Electric Power Co., which will extend from Pickle Meadows, near Bridgeport, Cal., to Tonopah and Manhattan, a distance of 220 miles.

It is roughly estimated that last winter's cut in Maine was about 800,000,000 feet of spruce and perhaps 100,000,000 feet of pine.

Method of Constructing a High-Pressure Concrete Pipe Water Main at Swansea, England.

A water main 3,600 ft. long and 19.7 ins. in diameter operating under a head of 185 ft. was built in 1905 at Swansea, England, of reinforced concrete pipe executed on the work under the patents of Mr. R. Bordenave of France. Fig. 1 shows the construction of the pipe, the drawing being a part longitudinal section through the shell at the joint. The pipe consists of an inner and an outer reinforcement separated by a sheet steel tube and all embedded in a 1-2 mortar. Both inner and outer reinforcements consists of longitudinal bins of cruciforce (+) section wound by a spiral bar of the same section wired to them at every intersection. Only the outer reinforcement and the steel tube are considered in calculating the strength of the pipe, the inner reinforcement being considered as simply supporting the mortar.

Fabrication of Reinforcement.—The steel tube is made of 1 mm. (0.04 in.) thick sheets of steel bent to a cylinder and jointed longitudinally by welded butt joints, welded by a blow pipe using acetylene and oxygen. Tests of this welded joint by R. H. Wyrill, Waterworks Engineer, Swansea, showed it to be quite as strong as the unwelded steel cut from the shell. The circumferential joints of the tube were made by turning up the edges of the sheets and welding them; this gives a flexible watertight joint. The tube was made in lengths of 9 ft. 9½ ins. and its ends were turned up all around; just back from the turned-up ends a vertical sheet steel collar was welded to the tube to form a strip end for the external coating. These details are shown in Fig. 1. When the tube for a length of pipe is completed the inside shell reinforcement previously made is slipped into it and the outside shell reinforcement is formed on it as a mandril, as shown by Fig. 2.

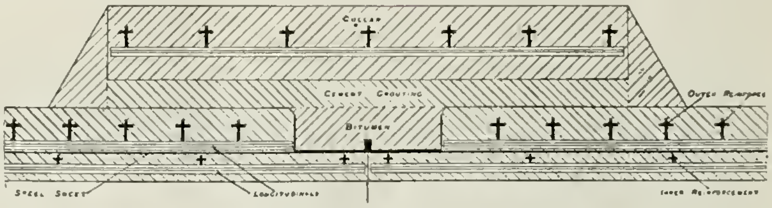


Fig. 1—Joint Construction, Bordenave Pipe.

Molding.—When the three positions of the steel skeleton were completed, as shown by Fig. 2, they were set on carved wooden curbs made to the exact shape necessary to center them and preserve the correct thickness of cement coating. A collapsible core was lowered into position in the inside, and a two-part sheet steel mold was erected outside; the space between core and mold was then paved with a thin mortar of one part Portland cement to two parts clean river sand. During the process of pouring, the outer steel mold is sharply struck with wooden mallets to facilitate the escape of air bubbles. The mortar was mixed on an elevated traveling platform which is shown in Fig. 3, which also shows a completed pipe, a core being withdrawn, a filled mold and a section of reinforcement set up. The difficult feature of the molding process was found to be the determination of the time for withdrawing the core and removing the exterior mold; the time of setting of the mortar was different in warm and in cool weather and varied with the wetness of the mixture, the brand of cement, etc. By using a single brand of cement that ran very uniform in quality and time of setting it was possible, however, for the workmen, after a little practice, to gauge very accurately the correct time for removing the molds. With four sets of molds a gang of eight men would curb 16 pipes per day under favorable conditions, but when the temperature was low it was not possible to make more than six or eight pipes. The pipes were allowed to stand four or five days after the removal of the mold; they could then be removed by a crane and laid in stock until used. It was found advisable to let the pipes age about four weeks before laying; by this time, it is stated, they would stand as much rough usage as cast iron pipe.

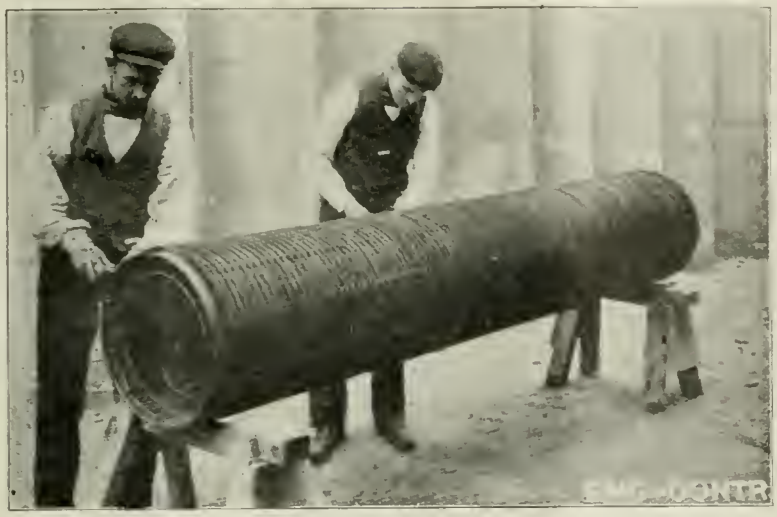


Fig. 2—Applying External Reinforcement to Bordenave Pipe.

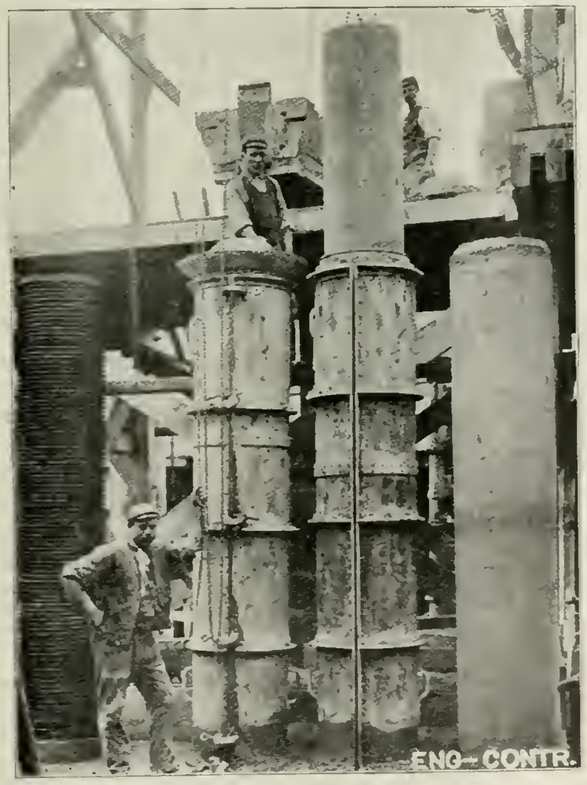


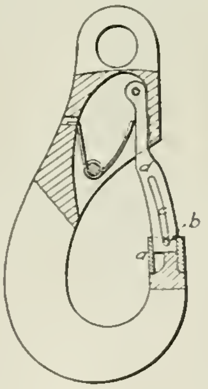
Fig. 3—Casting Bordenave Pipe at Swansea, England.

Laying.—The pipes were laid much in the same way as cast-iron pipes are laid; they were each 9 ft. 9½ ins. long and weighed each about 12 cwt., and were handled by ordinary tackle. In laying, the pipes were adjusted end to end and the joint enclosed by a temporary steel ring inside which the bitumen seal, Fig. 1, was run and allowed to set when the steel ring was removed. The joint was then encircled by a collar of similar construction to the pipe itself and the space between collar and pipe was poured with cement mortar. About ten lengths of pipe were laid per day by one gang of men, one jointer and his assistant making all the cement and bitumen joints as fast as the gang could lay the pipes.

The contractors for the work were the Columbian Fireproofing Co., Ltd., of London, England, owners in England of the Bornia patents; the engineer in charge was R. H. Wyrill, M. Inst. C. E., Waterworks Engineer, Swansea, England.

A Safety Locking Hook for Hoisting Tackle.

The safety locking hook shown in the accompanying sketch is described by Mr. Henry Louis in a note presented at the annual meeting of the North of England Institute of Mining and Mechanical Engineers. This hook is intended to take the place of the ordinary spring hook, which through the spring having become weak, bad loading of the bucket or other cause frequently fail safely to lock the bucket. As will be seen a sliding ferrule A is fitted to the tongue of the hook, being prevented from falling off by the pin passing through the slot in the tongue. To open the hook the ferrule is shut up on the tongue until it closes the point of the hook. When the hook is closed the ferrule drops by its own weight into locking position over the hook point. The tongue may be used without the spring if desired, but Mr. Louis prefers to retain it. These hooks have been used with entire success for some time.



Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

A High Cost for Shoveling Dirt.

In doing physical work it is very difficult for a man to maintain a rapid pace, when working by himself. It is necessary for rapid work to have a number of men in a gang. Then a stiffer pace is set and maintained, nor do the men feel as much used up at the end of the day as they do when they drag their work along. These things are understood on a race track, for a horse, to make a record, is never run without pace makers to spur them to do their best. Contractors often ignore these facts, and one man is set to do some one important task, when a small gang could work at it just as well and not only hasten the completion of the job but also cheapen it.

The following example illustrates this kind of an error of judgment on the part of a contractor. Sand had to be shoveled into a cart to be hauled an average distance of 150 ft. to be dumped behind a concrete wall. There was just 100 cu. yds. of sand to be moved. It was piled on the ground, and no picking was necessary, as it shoveled like sugar. Three men and a mule and cart were put on this work, instead of organizing the proper kind of a gang to close it up in a day, the contractor thinking that it was a matter of minor importance. The result was that the men lost time and made the cost exorbitant. With wages at $1.50 for a ten-hour day, the shoveling cost 34 cts. per cubic yard; while, allowing $1.50 per day for the cart, which was the prevailing price in that locality for hiring such a team, the hauling cost 10½ cts. per cubic yard.

This means that each man only loaded 4.4 cu. yds. per day, which was loafing pure and simple. In stiff clay a man will load into a cart at least 14 cu. yds. in 10 hours, while with lighter soils this will run up to 18 cu. yds. and may even go as high as 22 cu. yds. Gillette, in his "Earthwork and Its Cost," says regarding shoveling earth: "An engineer should base his estimate of cost on about 1.4 cu. yds. loaded per man-hour; whereas a contractor, who knows his foremen to be efficient, may figure on about 25 per cent better output, or as high as 2 cu. yds. an hour, and in exceptional cases on short rushed job 2.8 cu. yds. of soil per hour."

The material in the example given was of the easiest kind to shovel, and, if the contractor had put four carts at work and 8 men shoveling, there is no doubt that the cost of shoveling would not have been over 7½ cts. per cubic yard, making an output per man of 20 cu. yds. per day. This would have reduced the cost of hauling.

The contractor, by keeping cost data on this item learned a lesson, for when he again had to move some of this sand, 285 cu. yds., an average distance of 75 ft., a good size gang of men with wheelbarrows was put on the job. The result was that each man shoveled and wheeled 17½ cu. yds. per day, at a cost of 8½ cents per cubic yard. This was a good day's work, and a significant fact is that some of the same laborers worked on the two jobs.

A New Hose Coupling.

We show herewith a hose coupling designed to overcome the common defect of couplings, namely, leakage after having been in use for a while. The cut shows two halves of a "Dallett" coupling and the gasket used. The gasket is of a rubber composition, which is not affected by oil or gasoline, and is held in the female half of the coupling by a flange around the larger end, fitting into a recess. Upon connecting the coupling, the tapering end of the gasket enters the conical opening in the male part and fits closely therein. When pressure comes on the coupling, this tapered end of the gasket is expanded against the walls of the conical opening, making a tight joint, which the pressure of air or steam only makes tighter. As soon as the pressure is relieved, the gasket is again loose, and, no matter how long a coupling may remain connected, the gasket will not adhere to the metal and be torn in taking the coupling apart. The gasket can not fall out, and be lost when the coupling is disconnected, and a new gasket can be inserted in a few seconds when necessary. The coupling is made of hard bronze composition. It has no projecting parts to catch when the hose is trailing along the ground.

Cost of Trenching, Pipelaying and Back-filling for Pipe Sewer Construction at Centerville, Iowa.

In constructing some 11,739 ft. of 8, 10, 12 and 15-in. pipe sewers at Centerville, Ia., careful records of cost were kept by Mr. M. A. Hall, Centerville, Ia., engineer in charge. From these records, kindly furnished by Mr. Hall, the following tables have been compiled. The work comprised 30 separate jobs, or sections of sewer construction, and the tables give the labor hours and cost per lineal foot for each class of labor for each job. These are the fifth set of tables similarly detailed that we have published; preceding tables appeared in our issues of May 15, June 12, July 24 and Aug. 21. Altogether these tables constitute the most complete records of actual costs of pipe sewer work ever published.

Mr. Hall describes the methods of collecting the original data as follows:

"In the first place the account of the labor was kept by the inspector of the work and he had his instruction to be careful to account for all the men and where they worked. He was furnished with a blank and was required to turn these reports over to the engineer in charge each morning as he came on the work, of course turning in the report that covered the previous day's work. Together they would look over the report and make such corrections as might be necessary while the conditions were still fresh in mind. In this way what was considered to be an accurate account of the labor was obtained in a classified form so that by applying the wage per hour the daily cost could be easily obtained. However, no attempt was made to keep the actual cost for each day. It was kept rather by sections, as will be shown by the table to follow. Such other data as called for on the inspector's blanks were also obtained by the inspector each day. In but one or two instances did I have any trouble in getting accurate accounts from the inspectors, for, while it may seem strange to some, almost without exception the inspectors seemed to consider it a pleasure as well as a duty to take an interest in these reports. They received no compensation for this extra work. An important advantage in keeping the work by blocks or sections is evident, for in this way a good record could be kept of the kind of material excavated and its condition relative to easy or difficult moving. This part of the data was largely kept by myself and from my personal observation.

"Of course, there are always labor costs to the contractor which do not come under the observation of the inspector, and it is hard for anybody except the contractor to know what these costs are, and many times he could not separate these incidental costs such as handling tools, unloading and hauling materials, moving materials from place to place in order to use up all odds and ends possible, and various other minor costs. Hence it is very possible that labor costs deduced from these figures should be increased by some percentage which I would estimate at 10 per cent for the average case."

	JOB I.		JOB II.		JOB III.		JOB IV.		JOB V.		JOB VI.	
Size of pipe, ins.	15		15		15		15		15		12	
Length of pipe, ft.	296		523		376		592		326		424	
Average depth of trench, ft.	5.6		6.7		7.3		7.5		7.4		4.9	
Width of trench, ins.	36		36		36		36		36		24	
Excavation per lin. ft. of trench, cu. yds.	0.622		0.744		0.811		0.833		0.822		0.363	
Trenching:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour	177	$0.1076	1408	$0.4846	366	$0.1752	645	$0.1961	590	$0.3258	109	$0.0463
Total labor trenching	177	0.1076	1408	0.4846	366	0.1752	645	0.1961	590	0.3258	109	0.0463
Pipelaying:—												
Pipelayer at 30 cts. per hour	16	0.0162	57	0.0327	24	0.0192	37	0.0187	33	0.0304	31	0.0219
Pipelayer's helper at 17½ cts. per hour	33	0.0195	102	0.0341	48	0.0223	74	0.0219	66	0.0354	62	0.0256
Total labor pipelaying	49	0.0357	159	0.0668	72	0.0415	111	0.0406	99	0.0658	93	0.0475
General Service:—												
Foreman at 35 cts. per hour	15	0.0178	61	0.0408	35	0.0326	44	0.0260	50	0.0537	6	0.0049
Water boy at 12½ cts. per hour	15	0.0063	60	0.0143	35	0.0116	44	0.0093	50	0.0191	60	0.0177
Total labor general service	30	0.0241	121	0.0551	70	0.0442	88	0.0353	100	0.0728	66	0.0226
Backfilling:—												
By hand at 17½ cts. per hour	28	0.0166	97	0.0325	37	0.0172	100	0.0296	69	0.0370	39	0.0161
Team and two men at 52½ cts. per hour	7	0.0124	35	0.0351	7	0.0098	19	0.0168	24	0.0387	...	......
Total labor backfilling	35	0.0290	132	0.0676	44	0.0270	119	0.0464	93	0.0757	39	0.0161
Grand total labor	291	0.1964	1820	0.6741	552	0.2879	962	0.3184	882	0.5401	307	0.1325
Labor cost per cu. yd. trenching	$0.1730		$0.6513		$0.2160		$0.2354		$0.3964		$0.1275	
Labor cost per cu. yd. backfilling	0.0466		0.0909		0.0333		0.0557		0.0921		0.0444	

	JOB VII.		JOB VIII.		JOB IX.		JOB X.		JOB XI.		JOB XII.	
Size of pipe, ins.	12		12		12		12		12		12	
Length of pipe, ft.	449		333		246		373		256		440	
Average depth of trench, ft.	6.5		8.0		8.4		9.0		9.2		9.4	
Width of trench, ins.	24		24		24		24		24		24	
Excavation per lin. ft. of trench, cu. yds.	0.481		0.593		0.622		0.666		0.681		0.696	
Trenching:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour	421	$0.1688	726	$0.3924	320	$0.2342	557	$0.2688	415	$0.2918	899	$0.3678
Total labor trenching	421	0.1688	726	0.3924	320	0.2342	557	0.2688	415	0.2918	899	0.3678
Pipelaying:—												
Pipelayer at 30 cts. per hour	35	0.0234	49	0.0441	15	0.0183	47	0.0378	27	0.0316	40	0.0273
Pipelayer's helper at 17½ cts. per hour	70	0.0273	94	0.0494	30	0.0214	94	0.0441	54	0.0369	80	0.0318
Total labor pipelaying	105	0.0507	143	0.0935	45	0.0397	141	0.0819	81	0.0685	120	0.0591
General Service:—												
Foreman at 35 cts. per hour	40	0.0312	30	0.0315	15	0.0213	47	0.0441	14	0.0191	30	0.0591
Water boy at 12½ cts. per hour	40	0.0111	60	0.0225	15	0.0076	47	0.0158	14	0.0069	40	0.0114
Total labor general service	80	0.0423	90	0.0540	30	0.0289	94	0.0599	28	0.0260	70	0.0705
Backfilling:—												
By hand at 17½ cts. per hour	57	0.0222	74	0.0389	28	0.0199	99	0.0464	68	0.0465	78	0.0310
Team and two men at 52½ cts. per hour	18	0.0210	10	0.0158	4	0.0085	29	0.0408	8	0.0164	25	0.0298
Total labor backfilling	75	0.0432	84	0.0547	32	0.0284	128	0.0872	76	0.0629	103	0.0608
Grand total labor	681	0.3050	1043	0.5946	427	0.3312	920	0.4978	600	0.4492	1192	0.5582
Labor cost per cu. yd. trenching	$0.3509		$0.6627		$0.3765		$0.4032		$0.4285		$0.5283	
Labor cost per cu. yd. backfilling	0.0898		0.0922		0.0457		0.1308		0.0924		0.0874	

	JOB XIII.		JOB XIV.		JOB XV.		JOB XVI.		JOB XVII.		JOB XVIII.	
Size of pipe, ins.	12		12		12		12		12		12	
Length of pipe, ft.	352		106		230		241		496		256	
Average depth of trench, ft.	9.6		9.9		10.1		11.5		11.7		14.2	
Width of trench, ins.	24		24		24		24		24		24	
Excavation per lin. ft. of trench, cu. yds.	0.711		0.733		0.748		0.852		0.866		1.052	
Trenching:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour	840	$0.4295	448	$0.7608	537	$0.4203	904	$0.6752	1636	$0.5737	1408	$0.9900
Total labor trenching	840	0.4295	448	0.7608	537	0.4203	904	0.6752	1636	0.5937	1408	0.9900
Pipelaying:—												
Pipelayer at 30 cts. per hour	59	0.0503	10	0.0283	22	0.0287	44	0.0548	57	0.0345	41	0.0480
Pipelayer's helper at 17½ cts. per hour	111	0.0552	20	0.0330	44	0.0335	73	0.0530	99	0.0349	82	0.0561
Total labor pipelaying	170	0.1055	30	0.0613	66	0.0622	117	0.1078	156	0.0694	123	0.1041
General Service:—												
Foreman at 35 cts. per hour	59	0.0587	26	0.0859	50	0.0761	26	0.0377	79	0.0557	100	0.1367
Water boy at 12½ cts. per hour	59	0.0209	36	0.0424	40	0.0217	30	0.0156	79	0.0199	100	0.0488
Total labor general service	118	0.0796	62	0.1283	90	0.0978	56	0.0533	158	0.0756	200	0.1855
Backfilling:—												
By hand at 17½ cts. per hour	81	0.0403	10	0.0165	87	0.0662	105	0.0762	79	0.0279	56	0.0383
Team and two men at 52½ cts. per hour	14	0.0209	7	0.0347	35	0.0799	4	0.0087	22	0.0233	22	0.0451
Total labor backfilling	95	0.0612	17	0.0512	122	0.1461	109	0.0849	101	0.0512	78	0.0834
Grand total labor	1223	0.6758	557	1.0016	815	0.7264	1186	0.9212	2051	0.7899	1809	1.3630
Labor cost per cu. yd. trenching	$0.6041		$1.0379		$0.5619		$0.7925		$0.6856		$0.9411	
Labor cost per cu. yd. backfilling	0.0868		0.0698		0.1953		0.0996		0.6591		0.0793	

Job 1: Very easy digging in black loam. Job 2: Difficult and slow work, 1,050 cubic feet of rock. Job 3: Easy spading in black soil. Job 4: Clay, good spading, little water in ditch. Job 5: Difficult and slow work, 262 cubic feet of rock. Job 6: Hard work. 662 hr. on 1,164 cubic feet of rock in ditch, 92½ lbs. dynamite. Job 7: Easy spading in black soil, wet and bad weather. Job 8: Good clay digging, bad weather and ditch caved. Job 9: Fine clay spading, little water in ditch. Job 10: Moderate clay spading; crossed car track twice. Job 11: Good clay digging, dry and hard sandy bottom. Job 12: Good clay work, sandy, 100 feet wet ground filled with bats. Job 13: Good clay spading, wet weather made ditch cave. Job 14: Boulders in ditch, wet ground, 12 ft. concrete under bridge. Job 15: Good clay spading, dry sandy bottom. Job 16: Hard pan pick work in boulders; 60 feet concreted pipe. Job 17: Layer of boulders in trench 2 feet thick, pick work. Job 18: Very hard pick work in shale, rainy weather.

	JOB XIX		JOB XX.		JOB XXI.		JOB XXII.		JOB XXIII.		JOB XXIV.	
Size of pipe, ins	12		12		10		10		10		10	
Length of pipe, ft	348		215		252		258		209		122	
Average depth of trench, ft	10.3		10.9		7.6		8.6		9.7		10.0	
Width of trench, ins	24		24		24		24		24		24	
Excavation per lin. ft. of trench, cu. yds.	0.763		0.807		0.563		0.637		0.719		0.741	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour	1053	$0.5446	406	$0.3399	206	$0.1471	296	$0.2065	339	$0.2920	260	$0.3836
Total labor trenching	1053	0.5446	406	0.3399	206	0.1471	296	0.2065	339	0.2920	260	0.3836
PIPELAYING:—												
Pipelayer at 30 cts. per hour	36	0.0310	25	0.0349	20	0.0238	21	0.0244	28	0.0402	18	0.0443
Pipelayer's helper at 17½ cts. per hour	69	0.0347	45	0.0366	40	0.0278	42	0.0285	47	0.0394	36	0.0516
Total labor pipelaying	105	0.0657	70	0.0715	60	0.0516	63	0.0529	75	0.0796	54	0.0959
GENERAL SERVICE:												
Foreman at 35 cts. per hour	38	0.0382	39	0.0635	20	0.0278	29	0.0393	44	0.0737	20	0.0574
Water boy at 12½ cts. per hour	38	0.0137	39	0.0227	20	0.0099	29	0.0141	44	0.0263	20	0.0205
Total labor general service	76	0.0519	78	0.0862	40	0.0377	58	0.0534	88	0.1000	40	0.0779
BACKFILLING:—												
By hand at 17½ cts. per hour	123	0.0619	30	0.0244	27	0.0187	73	0.0495	47	0.0393	53	0.0760
Team and two men at 52½ cts. per hour	8	0.0121	19	0.0464	7	0.0146	23	0.0468	...	...	...	.....
Total labor backfilling	131	0.0740	49	0.0708	34	0.0333	96	0.0963	47	0.0393	53	0.0760
Grand total labor	265	0.7362	603	0.5684	340	0.2697	513	0.4091	549	0.5109	407	0.6334
Labor cost per cu. yd. trenching	$0.7137		$0.4212		$0.2613		$0.3242		$0.4061		$0.5177	
Labor cost per cu. yd. backfilling	0.1009		0.0865		0.0556		0.0151		0.0547		0.1026	

	JOB XXV.		JOB XXVI.		JOB XXVII.		JOB XXVIII.		JOB XXIX		JOB XXX.	
Size of pipe, ins	10		10		10		10		10		10	
Length of pipe, ft	206		240		123		471		246		376	
Average depth of trench, ft	10.0		10.6		10.9		11.7		12.0		12.2	
Width of trench, ins	24		24		24		24		24		24	
Excavation per lin. ft. of trench, cu. yds.	0.741		0.785		0.808		0.866		0.889		0.904	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour	437	$0.3818	653	$0.4897	462	$0.6761	1239	$0.4735	659	$0.4822	900	$0.4309
Total labor trenching	436	0.3618	653	0.4897	462	0.6761	1239	0.4735	659	0.4822	900	0.4309
PIPELAYING:—												
Pipelayer at 30 cts. per hour	30	0.0437	37	0.0463	23	0.0561	92	0.0586	30	0.0366	65	0.0519
Pipelayer's helper at 17½ cts. per hour	60	0.0510	42	0.0306	46	0.0654	120	0.0446	60	0.0427	130	0.0605
Total labor pipelaying	90	0.0947	79	0.0769	69	0.1215	212	0.1032	90	0.0793	195	0.1124
GENERAL SERVICE:—												
Foreman at 35 cts. per hour	30	0.0510	60	0.0875	37	0.1053	100	0.0743	33	0.0469	75	0.0698
Water boy at 12½ cts. per hour	30	0.0182	60	0.0313	37	0.0376	100	0.0265	33	0.0168	75	0.0249
Total labor general service	60	0.0692	120	0.1188	74	0.1429	200	0.1008	66	0.0637	150	0.0947
BACKFILLING:—												
By hand at 17½ cts. per hour	160	0.1410	144	0.1050	108	0.1537	367	0.1364	159	0.1131	239	0.1103
Team and two men at 52½ cts. per hour	...	.....			.	......	....	......	....	...		.....
Total labor backfilling	166	0.1410	144	0.1050	108	0.1537	367	0.1364	159	0.1131	239	0.1103
Grand total labor	752	0.6867	996	0.7904	713	1.0942	2018	0.8139	974	0.7383	1484	0.7483
Labor cost per cu. yd. trenching	$0.5152		$0.6240		$0.8368		$0.5458		$0.5424		$0.4877	
Labor cost per cu. yd. backfilling	0.1903		0.1338		0.1902		0.1575		0.1272		0.1220	

	JOB XXXI.		JOB XXXII.		JOB XXXIII.		JOB XXXIV.		JOB XXXV.		JOB XXXVI.	
Size of pipe, ins	10		10		10		10		10		10	
Length of pipe, ft	128		228		237		230		196		259	
Average depth of trench, ft	12.2		10.6		11.2		11.3		11.3		12.7	
Width of trench, ins	24		24		24		24		24		24	
Excavation per lin. ft. of trench, cu. yds.	0.904		0.785		0.83		0.837		0.837		0.941	
TRENCHING:	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour	541	$0.7608	449	$0.3545	763	$0.5795	552	$0.4320	381	$0.3499	757	$0.5261
Total labor trenching	541	0.7608	449	0.3545	763	0.5795	552	0.4320	381	0.3499	757	0.5261
PIPELAYING:—												
Pipelayer at 30 cts. per hour	36	0.0844	25	0.0329	36	0.0456	17	0.0222	27	0.0413	22	0.0255
Pipelayer's helper at 17½ cts. per hour	64	0.0875	50	0.0384	60	0.0443	34	0.0259	40	0.0357	40	0.0270
Total labor pipelaying	100	0.1719	75	0.0713	96	0.0899	51	0.0481	67	0.0770	62	0.0525
GENERAL SERVICE:												
Foreman at 35 cts. per hour	40	0.1093	29	0.0445	25	0.0369	11	0.0167	40	0.0714	9	0.0122
Water boy at 12½ cts. per hour	40	0.0391	29	0.0159	25	0.0132	11	0.0060	40	0.0255	20	0.0097
Total labor general service	80	0.1484	58	0.0604	50	0.0501	22	0.0227	80	0.0969	29	0.0219
BACKFILLING:												
By hand at 17½ cts. per hour	74	0.1012	56	0.0430	170	0.1220	73	0.0555	94	0.0839	39	0.0263
Team and two men at 52½ cts. per hour	..	...	4	0.0092	5	0.0111	23	0.0525	.	.	11	0.0223
Total labor backfilling	74	0.1012	60	0.0522	175	0.1331	96	0.1080	94	0.0839	50	0.0486
Grand total labor	795	1.1823	642	0.5384	1084	0.8526	721	0.6108	622	0.6077	898	0.6491
Labor cost per cu. yd. trenching	$0.8416		$0.4516		$0.6982		$0.5162		$0.4180		$0.5591	
Labor cost per cu. yd. backfilling	0.1118		0.0665		0.1616		0.1290		0.1002		0.0516	

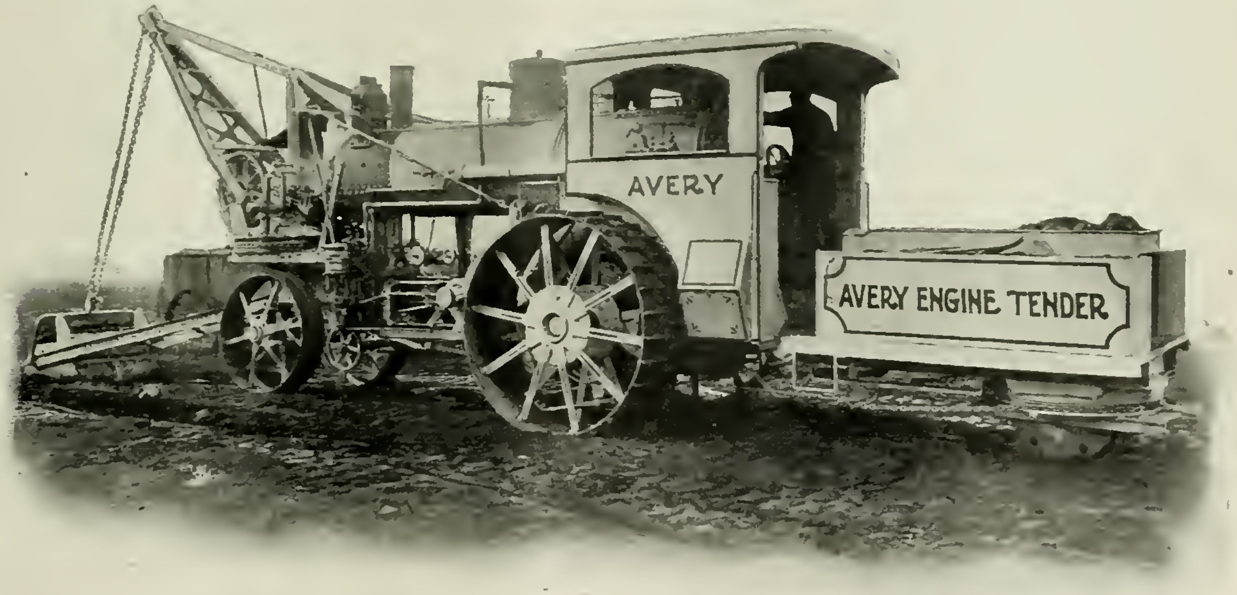
Job 19: Hard digging in rocky ground, 80 ft. con. pipe, 13 sacks cem., 4 yds. rock. Job 20: Filled ground, wet ditch, concreted pipe under bridge. Job 21: Fine clay spading, wet ditch with sandy bottom. Job 22: Good clay digging, narrow street crowded. Job 23: Close to street car track, dirt handled twice. Job 24: Clay work, cramped quarters, dirt handled twice. Job 25: Cavey ground, close to street car track, dirt shoveled twice. Job 26: Street car track, 144 hr. moving steel, close to gas tank. Job 27: Street car track, wet weather made very bad ditch. Job 28: Moderate digging in clay, crossed street car track. Job 29: Good clay work, but crowded quarters, dirt handled twice. Job 30: Good clay spading, 50 feet wet ditch, service pipes. Job 31: Spading hard, lost 100 feet of ditch from bad weather. Job 32: Moderate clay spading, cavey ditch, 33 feet street. Job 33: Rocks in ditch, bad weather for deep ditch. Job 34: Good clay spading, dirt handled twice, 33 foot street. Job 35: Hard clay spading, cramped quarters, 33 foot street. Job 36: Moderate clay spading, 33 foot street, dirt handled twice.

	JOB XXXVII.		JOB XXXVIII.		JOB XXXIX	
Size of pipe, ins.	8		8		8	
Length of pipe, ft.	784		199		96	
Average depth of trench, ft.	9.2		9.7		10.5	
Width of trench, ins.	24		24		24	
Excavation per lin. ft. of trench, cu. yds.	0.682		0.719		0.778	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour	1165	$0.2675	252	$0.2289	234	$0.4388
Total labor trenching	1165	0.2675	252	0.2289	234	0.4388
PIPELAYING:—						
Pipelayer at 30 cts. per hour	47	0.0180	21	0.0317	22	0.0688
Pipelayer's helper at 17½ cts. per hour	94	0.0210	32	0.0281	27	0.0492
Total labor pipelaying	141	0.0390	53	0.0598	49	0.1180
GENERAL SERVICE:—						
Foreman at 35 cts. per hour	51	0.0228	30	0.0528	20	0.0729
Water boy at 12½ cts. per hour	51	0.0081	30	0.0188	20	0.0260
Total labor general service	102	0.0309	60	0.0716	40	0.0989
BACKFILLING:—						
By hand at 17½ cts. per hour	161	0.0359	52	0.0457	104	0.1896
Team and two men at 52½ cts. per hour	23	0.0154	...	......	....	.. ..
Total labor backfilling	184	0.0513	52	0.0457	104	0.1896
Grand total labor	1592	0.3887	417	0.4060	427	0.8453
Labor cost per cu. yd. trenching	$0.3922		$0.3184		$0.5640	
Labor cost per cu. yd. backfilling	0.0752		0.0636		0.2437	

Job 37: Fine clay spading, 100 feet wet ditch, dry weather. Job 38: Fine clay spading, dry. Job 39: Hard digging, wet weather made sloppy backfilling.

A Traction Engine with Steam Shovel Attachment.

A traction engine is a good all-round machine for use on general contract work. Now, by an ingenious attachment, the manufacturers of the Avery traction engine, enable a contractor to convert his traction engine into a steam shovel. This attachment is illustrated herewith. It consists of a boom supporting a scraper at its forward end. The scraper is filled by pushing it along the surface of the ground, just as a drag scraper is filled, excepting that a drag scraper is pulled by horses, whereas the Avery scraper is pushed by an Avery traction engine. When the scraper is full of earth the boom is raised and the scraper is dumped into a wagon, car, or cart. The back of the scraper, or dipper, is hinged at the top. When the scraper is dropped down to dig, the swinging back closes and fastens with a hook. When dumping into a wagon the operator pulls a rope attached to the hook, releasing it, and the dirt falls into the wagon. Only two men are required to operate the machine.



Steam Shovel Attachment to a Traction Engine.

The shovel is said to be capable of loading 1 to 5 cu. yds. per minute, according to conditions.

The Avery traction engine is equipped with several attachments beside the scraper or shovel just described. A "steam plow," a tender, and a derrick are among the attachments. The derrick is a great convenience on general contract work. Heavy wagons, which can be coupled up in a train, are also made by this company.

There are several merits possessed by the shovel attachment, to which attention should be directed:

The outfit is quickly transported from place to place, making it especially suitable where the cuts are light, necessitating frequent shifting of the plant.

The shovel does not require a heavy cut in which to work to advantage. Since it works like an ordinary drag scraper, it is capable of skimming off a thin slice of earth a few inches thick, and is equally adapted to heavier work.

This machine is made by the Avery Manufacturing Co., Peoria, Ill.

Life of Timber Imbedded in Clay.

In a discussion on foundations, at the last annual meeting of the Am. Soc. C. E., Mr. John F. O'Rourke, president O'Rourke Engineering Construction Co., New York city, said:

"It is the writer's experience that wood, driven or placed in clay, is as completely preserved as though immersed in water; and, time and again, in the construction of foundations in the lower part of New York city, he has removed timber—mud sills and stringers—which had been placed above the water level, but in clay, more than 100 years before, and always found them in good preservation."

The editor can confirm this statement not only from observation in New York city, but from observation in Philadelphia. A few years ago, Market street, Philadelphia, was torn up during the laying of water pipes, and ancient wooden pipes were unearthed. These pipes had been buried so many years that all record of their existence had been lost, but that they had not been used for 100 years was quite certain. Nevertheless the wood was sound. The pipes had evidently been protected by the dense clay that surrounded them.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Methods and Costs; Some Old; Some New.

Flow of Artesian Wells.—The following method is sometimes used as an aid in calculating the flow of an artesian well. A bottle of aniline fluid is lowered into the well, and then by electrically exploding a cap the bottle is broken. The time required for the fluid to appear at the top gives an accurate gauge as to the velocity of the flow.

Mending Steel Tapes.—We illustrate herewith a simple device which has been used as an aid in mending steel tape. The device consists of a steel plate 2x1¼ in. by 1-16 in. thick, fastened to the top of a wooden block by screws having countersunk heads; above this is another plate of the same dimensions. Through both of these plates a row of holes, 1, 2, 3 and 4, is drilled and small wire nails driven into the wooden block, the nails serving to keep the tape in line and also to keep the top plate in position. Through both plates two other rows of smaller holes, about the size of a large pin, which makes a convenient rivet, are driven. The holes should be quite close together and yet cover enough length to provide for any angle of break. In repairing a broken tape it should be placed between the plates as shown in cut, the ends brought carefully together, and the whole then secured by using the stove bolts A. If the punch is strong enough the splicing piece and tape can be punched at the same time; otherwise after the holes in the tape are punched it can be removed and the splicing piece inserted and punched. The operation is completed by riveting the tape and splice together. Some surveyors contend that the splicing piece makes the repaired tape stiff, and they prefer the following method of mending a break: A flux is made by taking muriatic acid and putting into it a small piece of zinc; when the bubbles cease to rise sal-ammoniac is added until no more will dissolve. The break is cleaned thoroughly with an emery cloth and moistened with the flux. A small shaving of solder is then placed upon it and slowly heated with a flame and a blow-pipe until the solder melts and spreads on the tape; both sides of the tape are treated in this way. While the tape is still hot the solder is wiped with a piece of cloth until the joint is neatly tinned. A thin strip of copper ⅛ to ¼ in. wide, is then cleaned with the emery cloth and given a thick coat of tin and bent into a sleeve, the ends meeting in a butt joint. The sleeve is then put on the tape and slowly heated with the blow-pipe. When the solder is hot enough to run, the joint is clamped with pliers and when cool the copper sleeve is trimmed and the joint polished with emery cloth. It should be borne in mind that if the break to be mended is at an angle too large to be covered by a narrow sleeve, it is better to insert a piece of old tape 1 in. or more long and to use two sleeves.

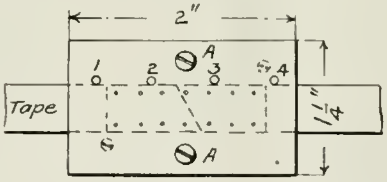
Equivalents for Hydraulic Computations.—The following table of convenient equivalents for use in hydraulic computations is taken from Water-Supply and Irrigation Paper No. 208, recently issued by the U. S. Geological Survey:

1 second-foot equals 40 California miner's inches (law of March 23, 1901.)

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 U. S. gals. per second; equals 448.8 gals. per minute: equals 646.272 gals. for one day.



Device for Mending Steel Tape.

1 second-foot equals 6.23 British imperial gals. per second.

1 second-foot for one year covers 1 sq. mile 1.131 ft. deep, 13.572 ins. deep.

1 second-foot for one year equals 31,536,000 cu. ft.

1 second-foot equals about 1 acre-in. per hour.

1 second-foot for one day covers 1 sq. mile 0.03719 in. deep.

1 second-foot for one 28-day month covers 1 sq. mile 1.041 ins. deep.

1 second-foot for one 29-day month covers 1 sq. mile 1.079 ins. deep.

1 second-foot for one 30-day month covers 1 sq. mile 1.116 ins. deep.

1 second-foot for one 31-day month covers 1 sq. mile 1.153 ins. deep.

1 second-foot for one day equals 1.983 acre-ft.

1 second-foot for one 28-day month equals 55.54 acre-ft.

1 second-foot for one 29-day month equals 57.52 acre-ft.

1 second-foot for one 30-day month equals 59.50 acre-ft.

1 second-foot for one 31-day month equals 61.49 acre-ft.

100 California miner's inches equal 18.7 U. S. gals. per second.

100 California miner's inches equal 96.0 Colorado miner's inches.

100 California miner's inches for one day equal 4.96 ft.

100 Colorado miner's inches equal 2.60 second-feet.

100 Colorado miner's inches equal 19.5 U. S. gals. per second.

100 Colorado miner's inches equal 104 California miner's inches.

100 Colorado miner's inches for one day equal 5.17 acre-ft.

100 United States gallons per minute equal 0.223 second-foot.

100 United States gallons per minute for one day equal 0.442 acre-ft.

1,000,000 United States gallons per day equal 1.55 second-feet.

1,000,000 United States gallons equal 3.07 acre-ft.

1,000,000 cubic feet equal 22.95 acre-ft.

1 acre-foot equals 325,850 gals.

1 inch deep on 1 square mile equals 2,323,200 cu. ft.

1 inch deep on 1 square mile equals 0.0737 second-foot per year.

1 foot equals 0.3048 meter.

1 mile equals 1.60935 kilometers.

1 mile equals 5,280 ft.

1 acre equals 0.4047 hectare.

1 acre equals 43,560 sq. ft.

1 acre equals 209 feet square, nearly.

1 square mile equals 2.59 square kilometers.

1 cubic foot equals 0.0283 cubic meter.

1 cubic foot equals 7.48 gals.

1 cubic foot of water weighs 62.5 lbs.

1 cubic meter per minute equals 0.5886 second-foot.

1 horsepower equals 550 foot-pounds per second.

1 horsepower equals 76.0 kilogram-meters per second.

1 horsepower equals 746 watts.

1 horsepower equals 1 second-foot falling 8.80 ft.

1⅓ horsepower equal about 1 kilowatt.

To calculate water power quickly:

$$\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11} = \text{net horsepower on}$$

water wheel, realizing 80 per cent of theoretical power.

The Isthmian Canal Commission is considering a plan by which European laborers on the Isthmus may bring their families there. It contemplates the erection of houses and establishing settlements in close proximity to the place of work.

The Life of Steel in Foundations Exposed to Water.

One of the subjects for informal discussion at the last annual convention of the Am. Soc. C. E. was:

"Will iron or steel used in foundations, independently or in combination with other materials, last indefinitely when in direct contact with water?"

The most valuable contribution to this discussion was made by Mr. John F. O'Rourke, president O'Rourke Engineering Construction Co., New York city. We quote:

"Iron and steel used in foundations, apart from conditions where electrolysis may occur, last indefinitely when in direct or indirect contact with water, provided the water remains unchanged. The reason for this is obvious. Water attacks iron or steel on account of the oxygen it contains, and, if this is a proportionately small quantity, the amount of oxygen contained in wet concrete or ground is negligible, and, having once been exhausted, the metal remains unharmed and protected.

"The writer has seen many cases where immersion in standing water has been a matter of years, and in every case the effect upon the metal has been no greater than if it had stood for the same length of time in linseed oil. In one case bolts on the inside of cast-iron cylinders, filled with concrete, were exposed to the salt water in the Harlem River for more than 30 years, and when removed were found to be without rust. In another case a pipe was immersed for ten years in an artesian well, the water in which had not been pumped for 10 or 15 years, and no corrosion of this inside pipe had taken place, the scale was still as fresh as when the pipe was new, and the tool marks of the pipe-coupling apparatus were still perfectly fresh.

"Similar results came under the writer's observation in reference to the condition of rods and nails found in wooden foundations where the surrounding material was impervious to air, and in one case which came under his observation, at the time of the removal of the old elevated railway columns in Greenwich street, New York city, prior to making way for the new structure in 1878, the bottom part of these columns and the bolts in the masonry were found intact, the corrosion gradually increasing until near the surface, where the material was almost entirely destroyed by rust. This experience with both wood and iron, where the renewal of the oxygen in the surrounding water was prevented, has been uniformly that of finding the material perfectly preserved, so that, in the writer's practice, he does not hesitate to advise the use of either material under conditions where a fresh supply of oxygen is excluded. The casing of concrete, in his belief, is an absolute protection against any oxygen penetrating to the surrounding water, and the uniform practice in foundation work in New York city, where both materials are used in combination, is to pay no attention to water-proofing as a preservation, but depend on the concrete to preserve the iron, which it does in the manner stated. There are exceptions to this, of course, but, generally speaking, where the water-proofing is put underneath the steel, it is for reasons connected with the water-proofing itself, more than from any intention to protect the steel in that way. As a matter of fact, water in one form or another is always a possibility, but conditions can be insured which will prevent its being changed, which is the great desideratum."

Production of Brick and Average Price in United States in 1906.

The following data on the production of common brick, paving brick and front brick are taken from a table of statistics on the clay products of the United States for 1906, recently issued by the U. S. Geological Survey:

STATE.	COMMON BRICK.		VITRIFIED PAVING BRICK OR BLOCK.		FRONT BRICK.	
	Quantity. (Thousands.)	Average price per thousand	Quantity. (Thousands.)	Average price per thousand	Quantity. (Thousands.)	Average price per thousand
Alabama	166,225	$6.30	*	$11.62	*	$11.35
Arizona	10,953	8.49			*	20.00
Arkansas	72,305	6.77	*	12.00	539	11.22
California	278,780	7.05	*	18.49	18,421	27.24
Colorado	120,944	6.51	6,239	11.93	24,147	10.63
Conn. & Rhode Island	212,648	7.07	*	16.36	*	16.51
Delaware	28,004	7.95			*	18.97
District of Columbia	32,597	7.43			*	13.05
Florida	42,635	6.69				
Georgia	303,286	5.88	*	13.99	2,094	9.91
Idaho and Nevada	32,757	8.31	*	26.50	425	23.75
Illinois	1,195,210	4.79	122,227	10.69	30,022	11.37
Indiana	307,076	5.79	45,725	10.99	35,090	11.27
Indian Territory	41,913	6.03	2,169	9.33	733	11.48
Iowa	168,871	6.62	16,930	10.99	8,871	11.48
Kansas	314,371	4.38	78,199	8.42	19,875	9.44
Kentucky	142,185	6.20	*	14.13	11,893	9.23
Louisiana	116,073	6.99	*	10.00	*	12.67
Maine	58,344	6.56	*	15.04	*	10.53
Maryland	204,238	6.21	*	15.60	2,266	14.11
Massachusetts	204,282	6.93			*	22.17
Michigan	206,583	5.70	6,229	13.13	1,474	9.61
Minnesota	165,598	5.96	*	10.68	7,510	13.07
Mississippi	121,107	6.62			1,051	11.94
Missouri	257,292	7.04	57,414	9.40	29,019	13.59
Montana	24,488	8.30	*	15.95	*	20.00
Nebraska	119,501	6.99	*	8.00	*	13.96
New Hampshire	95,770	7.48				
New Jersey	413,258	6.32	*	14.98	62,138	14.43
New Mexico	16,416	7.01	*	10.00	*	12.46
New York	1,535,579	6.00	10,787	15.20	23,625	14.89
North Carolina	166,338	6.26	*	10.00	385	11.45
North Dakota	25,972	7.86			2,732	18.70
Ohio	550,422	5.89	202,978	9.63	90,310	11.36
Oklahoma	33,918	6.90	*	8.00	559	11.00
Oregon	45,007	7.58			1,247	27.13
Pennsylvania	1,027,541	6.41	93,417	10.67	151,138	11.66
South Carolina	128,009	5.85			*	13.74
South Dakota	6,064	8.93			*	20.00
Tennessee	169,371	6.13	*	13.00	12,077	10.27
Texas	211,842	6.17	*	10.60	8,492	12.98
Utah	54,903	6.71			9,917	10.82
Vermont	13,836	6.20				
Virginia	232,697	6.60			25,385	15.45
Washington	99,788	7.10	9,609	16.28	4,439	27.66
West Virginia	74,833	6.27	47,902	12.07	*	15.00
Wisconsin	170,496	6.51			5,384	9.67
Wyoming	6,713	9.69			533	16.49
Other States†			52,149	12.23	25,678	13.84
United States	10,027,039	6.11	751,974	10.45	617,469	12.79
Total, 1905	9,817,355	6.25	665,879	10.07	541,590	13.12

* Included in "Other States."

† Includes all products made by less than three producers in one State.

The Chilean Government has authorized the General Director of the State Railways to expend nearly $2,000,000 upon different works, such as electric-light installation, railway construction, and the purchase of machinery.

Comparative Costs of Washing Out Locomotive Boilers.

The following, regarding the comparative cost of washing out locomotive boilers and filling them with cold and hot water, is abstracted from a paper on the subject read by H. M. Haig before the Traveling Engineers' Association, as reported in a recent issue of the Railway Age:

"At a certain locomotive terminal where 95 boilers are washed per month the cost of labor and fuel for each boiler washed is as follows:

1 man, 7 hrs. labor, at 18 cts	$1.26
1,500 lbs. coal for building fire at $2 per ton	1.50
200 lbs. coal for pumping 6,000 gal. water to cool boiler	.20
Total	$2.96

"With a system of hot water washing investigated by those in charge of this terminal, three hours per boiler washed was considered a conservative estimate. The corresponding cost per boiler washed with the hot water system would be:

1 man, 3 hrs. labor, at 18 cts	$0.54
900 lbs. coal for building fire, at $2 per ton	0.90
Total	$1.44

"According to these figures, the saving in labor and fuel for each boiler washing would be $1.52. Washing 95 boilers per month would represent a saving of $144.40 per month, or $1,732.80 per year.

"A further economy represented by the hot water system is in the shorter terminal detention. The earning capcity of a locomotive is realized when it is on the road and not when it is in the roundhouse undergoing repairs."

The first number of the Canal Record, the new weekly newspaper published under the authority of the Isthmian Canal Commission and edited by Secretary Bishop of the Commission, has been issued. "The primary purpose of the Canal Record," it is stated, "is the publication of accurate information, based upon official records, concerning all branches of the work of canal construction. In addition, there will be published information in regard to the social life of the zone, its amusements, sports and other activities. Space will also be given to letters from employes relating to any topic upon which they may choose to write."

The Colombian government has entered into a new contract with Carlos Tanco for the construction of railways in the Department of Tolima, granting him a concession for 50 years, with the exclusive privilege of constructing, equipping, operating, and exploiting a new line from Espinal to Ibague, and one from Espinal toward the south to Nevia.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0346. **Hydraulic Pumps.**—The Watson-Stillman Co., New York, N. Y.

The hydraulic pumps manufactured by this company range in size from small hand pumps to the largest high pressure steam power machines. This pamphlet illustrates, describes and gives the price of each of its patterns of pumps. It closes with a series of tables useful to the engineer who is installing machinery for hydraulic pressure purposes.

No. 0347. **Cotton Seed Oil Mill Machinery.**—The Foos Manufacturing Company, Springfield, Ohio.

This is an illustrated descriptive catalog of attrition mills, oil cake breakers, hullers, shakers, separators and similar machinery used in the preparation of cotton seed oil. Each machine is illustrated and briefly described, and in case of the attrition mill the illustrations and description are in detail, each part being taken up, illustrated by drawings and described. For anyone interested in this class of machinery, the catalog should prove to be valuable.

No. 0348. **Riveting Forges and Appliances.**—Gunnell Machine Co., Manitowoc, Wis.

These two circulars describe, first, a pneumatic forge for riveting work, and, second, a pneumatic holder-on. Several claims of special merit are made for each of these devices, and the circular should prove of interest to structural iron workers and contractors having riveting work to do.

No. 0349. **Road Oil.**—Petrolithic Pavement Co., Los Angeles, Cal.

In developing the system of road construction known as Petrolithic Pavement experiments were made with a great variety of oils to determine the one best fitted to give a durable and solid construction. The oil finally selected by the company is known as "Adeline Sunset Oil" and the company is now prepared to put it on the market for the use of builders of oil roads.

No. 0350. **Electric Fans.**—B. F. Sturtevant Co., Boston, Mass.

This circular illustrates and describes at considerable length the construction, operation and special merits of the electric propeller fan made by the firm named. Tables are given showing the capacity of different fans, the horsepower required to operate them, and other similar data of use to the engineer who has to install one or a system of these fans.

No. 0351. **Pumping Machinery.**—The American Well Works, Aurora, Ill.

This is a descriptive catalog and price list of the various styles of pumps and pumping engines made by the company named. Each machine is described and illustrated with all necessary dimensions, figures of capacity, etc. The pamphlet also contains a number of tables of useful hydraulic information such as friction of water in pipes, theoretical horsepower required to raise water to different heights, and capacity table of water cylinders.

No. 0352. **Venturi Meters.**—Builders' Iron Foundry, Providence, R. I.

These are a series of pamphlets illustrating and describing the peculiar features of the Venturi Meter. The most important of the several pamphlets is one containing a reprint of a paper by Mr. Clemens Herschel, the inventor of the meter, read before the American Society of Civil Engineers and describing and discussing the operation of his invention in detail.

No. 0353. **Contractors' Tents.**—The J. A. McAuley Tent & Awning Co., Columbus, Ohio.

This pamphlet gives sizes and prices of the various forms of contractors and engineers' tents made by the company named. These tents are made of various weights of duck and in all the forms and sizes likely to be used by contractors, engineers or others. The company also makes tarpaulins, horse covers, wagon covers and similar articles.

No. 0354. **Blue Printing Machine.**—Buckeye Engine Co., Salem, Ohio.

The blue-printing machine manufactured by this company is an electrical machine and this pamphlet is given up entirely to the reproduction of letters received from customers who have used the machine and have obtained satisfactory results with it.

No. 0355. **Concrete Pipe.**—The Reinforced Concrete Pipe Co., Jackson, Mich.

The concrete pipe described in this pamphlet is cast separately and then laid in a trench exactly as is vitrified sewer pipe. The pamphlet shows illustrations of the pipe, describes the method of molding and casting it, and illustrates a number of places where it has been used. One of the most important installations, that at St. Joseph, Mo., is described in detail. The pamphlet also shows the company's method of constructing reinforced concrete manholes.

Personals.

Mr. William L. Pyne has been appointed to the position of Assistant Engineer in the Bureau of Sewers, Queens Borough, New York City.

Mr. F. E. Trask, Consulting Civil and Hydraulic Engineer, has changed his office from 311-312 Citizens National Bank Bldg., Los Angeles, Cal., to 421-425 Homer Laughlin Bldg., that city.

Mr. C. Dickens Sternfels has resigned as advertising manager for Arthur Koppel Co. to take charge of a newly organized publicity department for the Standard Roller Bearing Co. of Philadelphia, Pa.

Mr. John R. Leighty has resigned his position as Division Engineer of the Baltimore & Ohio R. R., to become Chief Engineer of the Southern Division of the Missouri Pacific R. R., with headquarters in St. Louis, Mo.

Mr. J. E. Murphy has resigned his position as Resident Engineer of the Louisiana Western R. R. at Lafayette, La. He is succeeded by Mr. John Murphy, Roadmaster of the Houston & Texas Central R. R., at Corsicana, Tex.

Mr. Lyman H. Toombs, manager of the Book Department of the Myron C. Clark Publishing Co., Chicago, Ill., and Miss Edith B. Barteau, were married Sept. 10, at Hauppauge, N. Y.

Mr. Thomas Sollitt, one of the oldest contractors in Chicago, Ill., died Sept. 9, at his home in that city, after a two weeks' illness, of appendicitis. Mr. Sollitt was 81 years and for the last 21 years had been retired from business.

Mr. W. I. Porter has been appointed Chief Engineer of the Santa Fe, Liberal & Englewood R. R., now under construction from Des Moines, N. Mex., through Beaver County, Oklahoma, to Liberal and Englewood, Kans. He succeeds Mr. W. P. Halliday, resigned.

Mr. J. G. Ellendt and Mr. O. L. Griffith have severed their connection with the Concrete Engineering & Supply Co., and together with Mr. C. E. Tirrell, have organized the J. G. Ellendt Co. They will engage in consulting engineering and in contracting on reinforced concrete work, with offices at No. 1 Madison Ave., New York City.

Messrs. D. C. & Wm. B. Jackson, Consulting Engineers for Electric and Allied Properties, have removed their western office from Madison, Wis., to the Commercial National Bank Bldg., Chicago, Ill., and in the near future they will open an office in Boston, Mass. Mr. William J. Crumpton will be in immediate charge of the Chicago office.

Col. Robert I. Fleming, a well-known architect, contractor and builder of Washington, D. C., died Sept. 11, at his country home, Oak View, Cleveland Park. He was born in 1842 and served through the Civil War in the Confederate Army. In 1865 he began business in Richmond, Va., as an architect and builder, shortly after being appointed Assistant City Engineer. He came to Washington in 1867.

The following appointments to the position of Assistant Engineer (designer) have been made by the Board of Water Supply of New York City: Wm. Meadowcroft, 104 West 94th St., New York; James Owen, 74 Hicks St., Brooklyn; John Peterson, 2 Elinor Place, Caryl, Yonkers, N. Y.; Torris Eide, 59 Grove St., Elmhurst, L. I.; Halsey French, 110 West 95th St., New York; Roger W. Armstrong, 144 65th St., New York; James E. Barlow, 36 East 28th St., New York; Arthur R. Holbrook, 104 West 94th St., New York; Chas. S. Landers, 44 West 44th St., New York; Frank A Bayley, 25 South Oxford St., Brooklyn.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Sept. 18.	Houston, Texes	Sept. 4
Sept. 18.	Fort Wayne, Ind	Sept. 11
Sept. 18.	Fort Wayne, Ind	Sept. 11
Sept. 20.	Cincinnati, O.	Sept. 11
Sept. 20.	Greeley, Colo.	Sept. 11
Sept. 20.	Tiffin, O.	Sept. 18
Sept. 23.	Newark, O.	Sept. 4
Sept. 23.	Akron, O.	Sept. 18
Sept. 25.	Memphis, Mo.	Sept. 18
Sept. 27.	Denver, Colo.	Sept. 11
Sept. 30.	Oakland, Cal.	Sept. 11
Sept. 30.	Lancaster, Pa.	Sept. 18
Sept. 30.	Santiago, Cbile	July 17
Sept. 31.	Guthrie, Okla.	Sept. 4
Oct. 3.	Fergus Falls, Minn.	Sept. 18
Oct. 7.	Salem, Ind.	Sept. 11
Oct. 7.	Warren, O.	Sept. 18
Oct. 7.	Vevay, Ind.	Sept. 18
Oct. 7.	Vicksburg, Miss.	Sept. 18
Oct. 8.	Harrisburg, Pa.	Sept. 18
Oct. 8.	Delphi, Ind.	Sept. 18
Oct. 8.	Vicksburg, Miss.	Sept. 18
Oct. 14.	Los Angeles, Cal.	Sept. 11
Oct. 14.	Fredericton, N. B.	Sept. 18
Oct. 15.	Dunrea, Man.	Sept. 4
Oct. 15.	Erie, Kan.	Sept. 18
Oct. 19.	Canton, China	Sept. 4

Buildings.

Sept. 18.	Chicago, Ill.	Sept. 11
Sept. 18.	Cincinnati, O.	Sept. 11
Sept. 18.	Edgewater, N. J.	Sept. 11
Sept. 18.	Delavan, Wis.	Sept. 11
Sept. 18.	Agricultural College, Mich.	Sept. 11
Sept. 19.	Muscatine, Ia.	Aug. 14
Sept. 19.	Chicago, Ill.	Sept. 11
Sept. 19.	Minneapolis, Minn.	Sept. 18
Sept. 20.	Chicago, Ill.	Sept. 11
Sept. 20.	Boston, Mass.	Sept. 18
Sept. 21.	Indiana, Pa.	Sept. 18
Sept. 23.	Cedar Rapids, Ia.	Aug. 14
Sept. 23.	Washington, D. C.	Sept. 11
Sept. 23.	New York, N. Y.	Sept. 18
Sept. 23.	Brooklyn, N. Y.	Sept. 18
Sept. 23.	Brookline, Mass.	Sept. 18
Sept. 23.	Boston, Mass.	Sept. 18
Sept. 23.	Guttenberg, N. J.	Sept. 18
Sept. 24.	Hamilton, O.	Aug. 21
Sept. 24.	Danville, Pa.	Sept. 11
Sept. 24.	Minneapolis, Minn.	Sept. 18
Sept. 25.	Manitowoc, Wis.	Sept. 18
Sept. 26.	Muscatine, Ia.	Sept. 11
Sept. 26.	Riverside, Cal.	Sept. 11
Sept. 26.	New York, N. Y.	Sept. 18
Sept. 27.	Hesperus, Cal.	Sept. 11
Sept. 27.	Louisville, Ky.	Sept. 18
Sept. 28.	Fort Ethan Allen, Vt.	Sept. 18
Sept. 28.	South Sharon, Pa.	Sept. 18
Sept. 30.	Selma, Ala.	Aug. 28
Sept. 30.	West Point, N. Y.	Sept. 11
Sept. 30.	West Haverstraw, N. Y.	Sept. 18
Sept. 30.	Vincennes, Ind.	Sept. 18
Oct. 1.	Eau Claire, Wis.	Aug. 28
Oct. 1.	Pensacola, Fla.	Aug. 21
Oct. 1.	Indianapolis, Ind.	Sept. 4
Oct. 1.	Indianapolis, Ind.	Sept. 4
Oct. 3.	Bayonne, N. J.	Sept. 11
Oct. 5.	New Orleans, La.	Sept. 11
Oct. 5.	Mount Healthy, O.	Sept. 18
Oct. 7.	Baltimore, Md.	Aug. 28
Oct. 7.	Fort Slocum, N. Y.	Sept. 18
Oct. 12.	Prescott, Ariz.	Sept. 18
Oct. 14.	San Diego, Cal.	Sept. 11
Oct. 16.	Springfield, O.	Sept. 18
Oct. 17.	Peoria, Ill.	Sept. 11
Oct. 18.	Montenallo, Ala.	Sept. 18
Oct. 21.	Des Moines, Ia.	Sept. 11
Oct. 21.	Milwaukee, Wis.	Sept. 18
Oct. 30.	Terre Haute, Ind.	Sept. 18
Nov. 5.	Bloomfield, Ind.	Sept. 18

Roads and Streets.

Sept. 18.	Cincinnati, O.	Sept. 4
Sept. 18.	Brooklyn, N. Y.	Sept. 11
Sept. 18.	St. Joseph, Mich.	Sept. 11
Sept. 19.	Des Moines, Ia.	Sept. 11
Sept. 19.	Kansas City, Mo.	Sept. 11
Sept. 19.	Fort Wayne, Ind.	Sept. 11
Sept. 19.	Cincinnati, O.	Sept. 11
Sept. 19.	Dubuque, Ia.	Sept. 18
Sept. 20.	Rockville, Ind.	Aug. 28
Sept. 20.	Frankfort, Ind.	Sept. 4
Sept. 20.	Dallas, Tex.	Sept. 11
Sept. 20.	Buffalo, N. Y.	Sept. 11
Sept. 20.	Frankfort, Ind.	Sept. 11
Sept. 20.	Cincinnati, O.	Sept. 11
Sept. 20.	Valparaiso, Ind.	Sept. 18
Sept. 20.	Pittsburg, Pa.	Sept. 18
Sept. 20.	Bluffton, Ind.	Sept. 18
Sept. 21.	Silverton, O.	Sept. 11
Sept. 21.	Washington, D. C.	Sept. 11
Sept. 21.	Racine, Wis.	Sept. 11
Sept. 21.	Fort Williams, Me.	Sept. 18
Sept. 23.	Toledo, O.	Sept. 18
Sept. 23.	Syracuse, N. Y.	Sept. 18
Sept. 23.	Indianapolis, Ind.	Sept. 18
Sept. 23.	Ogden, Utah	Sept. 18
Sept. 24.	Lebanon, Ind.	Sept. 4
Sept. 24.	Woodcliff Lake, N. J.	Sept. 11
Sept. 24.	Philadelphia, Pa.	Sept. 18
Sept. 25.	University Heights, Ind.	Sept. 18
Sept. 25.	Richmond, Ind.	Sept. 18
Sept. 25.	Harrisburg, Pa.	Sept. 18
Sept. 26.	Danville, Ill.	Sept. 11
Sept. 26.	Fort Wayne, Ind.	Sept. 18
Sept. 26.	Bluffton, Ind.	Sept. 18
Sept. 26.	Kansas City, Mo.	Sept. 18
Sept. 26.	St. Paul, Minn.	Sept. 18
Sept. 26.	New York, N. Y.	Sept. 18
Sept. 28.	Manassas, Va.	Sept. 11
Sept. 28.	Vincennes, Ind.	Sept. 11
Sept. 28.	Greencastle, Ind.	Sept. 18
Sept. 30.	New York, N. Y.	Sept. 18
Oct. 1.	Billings, Mont.	Sept. 11
Oct. 1.	Durham, N. C.	Sept. 18
Oct. 1.	Fort Sam Houston, Tex.	Sept. 18
Oct. 3.	Harrisburg, Pa.	Sept. 18
Oct. 5.	Cleveland, O.	Sept. 18
Oct. 7.	Salem, Ind.	Sept. 11
Oct. 7.	Hartford City, Ind.	Sept. 18
Oct. 7.	Kenosha, Wis.	Sept. 18
Oct. 8.	Vincennes, Ind.	Sept. 11
Oct. 8.	Covington, Ind.	Sept. 18
Oct. 9.	Harrisburg, Pa.	Sept. 18
Oct. 10.	Harrisburg, Pa.	Sept. 18
Oct. 14.	Sunman, Ind.	Sept. 11

Sewers.

Sept. 18.	Brooklyn, N. Y.	Sept. 11
Sept. 18.	Chicago, Ill.	Sept. 11
Sept. 18.	Chicago, Ill.	Sept. 11
Sept. 18.	Oakland, Cal.	Sept. 11
Sept. 19.	Canton, Miss.	Sept. 4
Sept. 19.	Togus, Me.	Sept. 4
Sept. 19.	Fort Wayne, Ind.	Sept. 17
Sept. 19.	Milwaukee, Wis.	Sept. 18
Sept. 19.	Woonsocket, R. I.	Sept. 18
Sept. 19.	Wilkesbarre, Pa.	Sept. 18
Sept. 19.	Lima, O.	Sept. 18
Sept. 20.	Lakewood, O.	Sept. 18
Sept. 20.	Iowa Falls, Ia.	Sept. 18
Sept. 20.	Pittsburg, Pa.	Sept. 18
Sept. 21.	Aurora, Neb.	Sept. 11
Sept. 21.	Hamilton, O.	Sept. 11
Sept. 21.	Greenfield, Wis.	Sept. 18
Sept. 23.	New York, N. Y.	Sept. 18
Sept. 23.	Fort Madison, Ia.	Sept. 18
Sept. 23.	Indianapolis, Ind.	Sept. 18
Sept. 24.	Harrisburg, Pa.	Sept. 18
Sept. 25.	Brooklyn, N. Y.	Sept. 18
Sept. 25.	Richmond, Ind.	Sept. 18
Sept. 26.	New York, N. Y.	Sept. 18
Sept. 27.	Delaware, O.	Sept. 11
Sept. 27.	North Chicago, Ill.	Sept. 11
Sept. 30.	New York, N. Y.	Sept. 18
Sept. 30.	Washington, D. C.	Sept. 18
Sept. 30.	Seymour, Ind.	Sept. 18
Sept. 30.	Drayton, N. Dak.	Sept. 18
Sept. 30.	Steubenville, O.	Sept. 18
Oct. 1.	Cadillac, Mich.	Sept. 11
Oct. 1.	Paducah, Ky.	Sept. 11
Oct. 1.	Des Moines, Ia.	Sept. 18
Oct. 2.	Salem, Mass.	Sept. 18
Oct. 3.	Fort Dade, Fla.	Sept. 11
Oct. 5.	Bisbee, Ariz.	Sept. 18

Water Supply.

Sept. 19.	Charlotte, N. C.	Sept. 18
Sept. 20.	Canon City, Colo.	Sept. 4
Sept. 20.	Iowa Falls, Ia.	Sept. 18
Sept. 21.	Fort Oglethorpe, Ga.	Sept. 11
Sept. 21.	Greenfield, Wis.	Sept. 18
Sept. 24.	Milwaukee, Wis.	Sept. 18
Sept. 24.	Fort Wayne, Ind.	Sept. 18
Sept. 25.	Rome, N. Y.	Sept. 11
Sept. 25.	Highlands, N. J.	Sept. 11
Sept. 25.	Summit, Ill.	Sept. 11
Sept. 25.	Fort Morgan, Ala.	Sept. 11
Sept. 25.	Chicago, Ill.	Sept. 18
Sept. 25.	Elkins, W. Va.	Sept. 18
Sept. 26.	Fort Barrancas, Fla.	Sept. 11
Sept. 27.	Washington, D. C.	Sept. 4
Sept. 27.	Hesperus, Colo.	Sept. 11
Sept. 27.	Madison, Wis.	Sept. 18
Sept. 28.	Manassas, Va.	Sept. 11
Sept. 28.	Fort Ethan Allen, Vt.	Sept. 18
Sept. 30.	Wilmington, Del.	Sept. 11
Sept. 30.	Fremont, Neb.	Sept. 18
Sept. 30.	Beaver City, Neb	Sept. 18
Oct. 9.	Fort Caswell, N. C.	Sept. 18
Oct. 10.	Primghar, Ia.	Sept. 18
Oct. 10.	Fort Du Pont, Del.	Sept. 18
Oct. 23.	Atlanta, Ga.	Sept. 18

Miscellaneous.

——	Seymour, Ind.,	Lighting, Sept. 18
Sept. 18.	Roswell, N. Mex.,	Concrete Work, Sept. 11
Sept. 18.	Philadelphia, Pa.,	Grading, Etc., Sept. 18
Sept. 19.	Boston, Mass.,	Wrecking Work, Sept. 4
Sept. 19.	Kansas City, Mo.,	Tree Planting, Sept. 11
Sept. 20.	Indianapolis, Ind.,	Dam Repairs, Sept. 11
Sept. 20.	Pittsburg, Pa.,	Concrete Steps and Wall, Sept. 18
Sept. 21.	Portsmouth, N. H.,	Power House, Sept 4
Sept. 21.	Chicago, Ill.,	Wire and Concrete Fence, Sept. 18
Sept. 24.	Newport, R. I.,	Ferry Slips, Sept. 18
Sept. 25.	Reading, Pa.,	Subway, Sept. 11
Sept. 25.	Vancouver Barracks, Wash.,	Coal Sheds, Scale, Sept. 11
Sept. 26.	Fort Dupont, Delaware City, Del.	Freight Wharf, Sept. 4
Sept. 26.	Fort Dupont, Del.,	Wharf Work, Sept. 11
Sept. 26.	New York, N. Y.,	Track Work, Sept. 18
Sept. 26.	Newark, N. J.,	Garbage Disposal, Sept. 18
Sept. 27.	Pittsburg, Pa.,	Monument, Sept. 11
Sept. 27.	New York, N. Y.,	Pier Extension, Sept. 18
Sept. 28.	San Francisco, Cal.,	Wharf, Sept. 18
Sept. 30.	Washington, D. C.,	Search Light Outfit, Aug. 7
Sept. 30.	Cincinnati, O.,	Dredge, Sept. 11
Sept. 30.	Philadelphia, Pa.,	Dredge, Sept. 11
Oct. 1.	Winnipeg, Man.,	Hydro-Electric Station, Sept. 4
Oct. 1.	Fort Dade, Fla.,	Wire Fence, Sept. 11
Oct. 3.	Wilmington, Del.,	Stone Jetties, Sept. 11
Oct. 5.	Franklin Shoals, Ark.,	Lock and Dam, Aug. 7
Oct. 5.	Mobile, Ala.,	Locks and Dams, Aug. 14
Oct. 5.	Mobile, Ala.,	Locks and Dams, Sept. 11
Oct. 5.	Vicksburg, Miss.,	Lock and Dam, Aug. 14
Oct. 7.	Toledo, O.,	Riprap Wall, Sept. 18
Oct. 7.	New Orleans, La.,	Flagstaff, Sept. 18
Oct. 31.	Mobile, Ala.,	Snagboat, Sept. 11
Nov. 15.	Charleston, S. C.,	Street Lighting, Sept. 11

Excavation, Earth and Rock.

Sept. 18.	Seattle, Wash.,	Dredging, Sept. 4
Sept. 18.	St. Charles, Ill.,	Drains, Sept. 11
Sept. 18.	Washington, D. C.,	Dredging, Sept. 11
Sept. 19.	Gardner, Me.,	Dredging, Aug. 28
Sept. 19.	Boone, Ia.,	Tile Drain, Sept. 11
Sept. 20.	Dakotah, Ia.,	Drain, Sept. 11
Sept. 20.	New Orleans, La.,	Levee Work, Sept. 18
Sept. 21.	Vernon City, Minn.,	Ditch Work, Sept. 18
Sept. 23.	Bay City, Mich.	Embankment, Sept. 11
Sept. 23.	Saginaw, Mich.,	Dredging, Filling, Sept. 18
Sept. 24.	Rockwell City, Ia.,	Ditch Work, Sept. 18
Sept. 26.	San Francisco, Cal.,	Dredging, Sept. 11
Sept. 27.	Cerro Gordo, Ill.,	Ditch Work, Sept. 18
Sept. 30.	New York, N. Y.,	Dredging and Rock Removal, Sept. 4
Sept. 30.	Boston, Mass.,	Dredging, Sept. 11
Sept. 30.	Charleston, Miss.,	Ditch Work, Sept. 18
Oct. 1.	Onawa, Ia.,	Ditch, Sept. 18
Oct. 7.	Detroit, Mich.,	Excavating, Sept. 4
Oct. 8.	Detroit, Mich.,	Dredging, Sept. 4

Oct. 8. Muscatine, Ia., Ditch Work, Sept. 18
Oct. 9. Jacksonville, Fla., Dredging, Sept. 18
Oct. 10. Peterboro, Ont., Canal, Sept. 4
Oct. 10. Jacksonville, Fla., Rock Removal, Sept. 18
Oct. 10. Washington, D. C., Dredging, Jetty Work, Sept. 18
Oct. 12. Riverton, Ala., Excavation, Riprap, Sept. 18

Materials, Machines, Supplies, Tools Etc

Sept. 18. Washington, D. C., Pneumatic Tools, Etc., Sept. 11
Sept. 20. Chicago, Ill., Electric Light Wire, Sept. 11
Sept. 23. New York, N. Y., Rubble Stone, Sept. 18
Sept. 24. Pensacola, Fla., Cement, Pipe, Drills, Sept. 18
Sept. 24. Washington, D. C., Brick, Cement, Machinery, Sept. 18
Sept. 24. New Orleans, La., Lumber, Sept. 18
Sept. 24. Annapolis, Md., Bolts, Poles, Pipe, Sept. 18
Sept. 24. New York, N. Y., Steam Hammer, Pipe, Etc., Sept. 18
Sept. 24. League Island, Pa., Piles, Lumber, Sept. 18
Sept. 24. Newport, R. I., Wire Rope, Pipe, Sept. 18
Sept. 24. Charleston, S. C., Motor Drive, Pipe, Etc., Sept. 18
Sept. 24. Norfolk, Va., Pipe, Gravel, Machinery, Sept. 18
Sept. 25. Washington, D. C., Machinery, Sept. 4
Sept. 26. New York, N. Y., Fence, Lumber, Etc., Sept. 18
Sept. 30. Cincinnati, O., Dredging, Sept. 4
Sept. 30. Los Angeles, Cal., Water Pipe and Pumping Machinery, Sept. 4
Sept. 30. West Point, N. Y., Gas and Electric Fixtures, Sept. 4
Sept. 30. New London, Conn., Generating Sets, Sept. 11
Sept. 30. Rochester, N. Y., Electric Plant, Sept. 11
Oct. 1. Mare Island, Cal., Brick, Pump, Etc., Sept. 11
Oct. 4. Jacksonville, Fla., Generator, Etc., Sept. 11
Oct. 5. Washington, D. C., Launch, Hammers, Bolts, etc., Sept. 11
Oct. 5. Kewanee, Ill., Pumping Equipment, Sept. 18
Oct. 15. Honolulu, T. H., Materials, Sept. 4

BIDS ASKED.

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by state:

Delphi, Ind.—Until noon, Oct. 8, by County Auditor, for construction of bridge and abutments over Rock Creek.

Vevay, Ind.—Until 2 p. m., Oct. 7, by L. J. Woollen, County Auditor, for constructing either concrete or iron bridge over Plum Creek to replace 144 ft. 3-span bridge.

Erie, Kan.—Until noon, Oct. 15, by O. M. Johnson, County Clerk, for construction of three steel or iron bridges, one to cost about $12,000; the other to cost $6,000 or $7,000 each. The official advertisement will be found elsewhere in this issue.

Fergus Falls, Minn.—Until 8 p. m., Oct. 3, by G. H. Gard, City Clerk, for constructing steel or concrete bridge over Red River. River is 75 ft. wide, water is 3 ft. deep, and depth of street above river is 30 ft. Bidders to furnish plans and specifications.

Vicksburg, Miss.—Until noon, Oct. 8, by J. D. Laughlin, Chancery Clerk, for building steel bridge over Simrall's Canal, and until Oct. 9, for repairs to Durden Bridge. Certified check for $1,000 required.

Vicksburg, Miss.—Until Oct. 7, by H. J. Trowbridge, City Clerk, for 4 concrete bridges. W. G. Kirkpatrick, Engineer, Jackson, Miss.

Memphis, Mo.—C. C. Critz, Commissioner, will let contracts for 32 ft. span and a 16 ft. trestle on Sept. 25 and 26.

Harrisburg Pa.—Until Oct. 8, by State Board Public Grounds and Buildings, Samuel Rambo, Supt., State Capitol, for erection of bridge at Jersey Shore, C. Oscar Thomson, Phoenixville, Engineer, and for bridge in Sugar Loaf Township, Herman Laub, Pittsburg, Engineer.

Lancaster, Pa.—Until noon, Sept. 30, by M. G. Schaeffer, County Controller, for stone twin arch or reinforced concrete bridge over Hammer Creek.

Fredericton, N. B.—Until Oct. 14, by C. H. La Billois, Commissioner Department of Public Works, for constructing metal superstructure span of Cocagne Mouth bridge, Kent County.

Tiffin, O.—Until Sept. 20, by County Auditor, for building bridge over Sandusky River at Perry St.

Akron, O.—Until Sept. 23, by County Auditor, for considerable amount of bridge work, including new bridge over Wolf Creek near Barberton and bridge south of Loyal Oak.

Warren, O.—Until 1 p. m., Oct. 7, by County Auditor, for reconstructing floor of bridge over Mahoning River, Main St., Niles.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Montevallo, Ala.—Until Oct. 18, for plumbing, electric wiring and steam heating for Alabama Girls' Industrial School. Wm. E. Spink, Arch., 812 Title Guarantee Bldg., Birmingham, Ala.

Prescott, Ariz.—Until 10 a. m., Oct. 12, by Capt. Chas. C. Walcutt, Jr., Q. M., and for construction, plumbing, hot water heating and electric wiring, hospital at Whipple Barracks, Ariz.

Fort McPherson, Ga.—Constructing Q. M., will shortly call for bids for constructing brick stable for 76 animals; also frame wagon shed.

Terre Haute, Ind.—Until noon, Oct. 30, by Jerome W. Denehie, County Auditor, for construction of new county jail, sheriff's residence, and heating plant, including remodeling the present jail.

Bloomfield, Ind.—Until 2 p. m., Nov. 5, by Peter M. Cook, County Auditor, for new jail cell house. J. W. Gaddis, Arch., Vincennes, Ind.

Vincennes, Ind.—Until 2 p. m., Sept. 30, by Building Committee, 1st Baptist Church, for erecting church building.

Louisville, Ky.—Until noon Sept. 27, by R. G. McGrath, Secy. Bd. Pub. Wks., for new power plant and steam heating apparatus in City Hall Annex and old engine house, and remodeling apparatus in old City Hall.

Boston, Mass.—Until 3 p. m., Sept. 20, by Park Commissioners, 64 Pemberton Sq., for building a brick sanitary and locker building on North Brighton playgrounds.

Boston, Mass.—Until noon, Sept. 23, by State Armory Commission, State House, for building new state armory on Bunker Hill St., Charlestown. Andrews, Jaques & Rantoul, Archs., 50 Congress St., Boston.

Brookline, Mass.—Until 4 p. m., Sept. 23, by William Craig, Chairman Selectmen, for building fire engine house. Freeman, Funk & Wilcox, Archs., 1 Harvard St., Brookline.

Minneapolis, Minn.—Until noon, Sept. 24, by Richard Tattersfield, Secy. Bd. Charities and Corrections, for installation of electric wiring for the Minneapolis City Workhouse office. L. A. Lamoreau, Architect, 516 Lumber Exchange.

Minneapolis, Minn.—Until 4 p. m., Sept. 17, by W. K. Hicks, Secy. Bd. of Education, for heating and ventilating plant of West High School Building. E. S. Stebbins, Architect, 614 Masonic Temple.

Guttenberg, N. J.—Until 6 p. m., Sept. 23, by James J. Moore, Clerk Board Education for alterations and additions to public school building. Emil Guhl, Arch., 18 Charles St., Jersey City.

West Haverstraw, N. Y.—Until noon, Sept. 30, by Rev. C. H. Potter, Pres., Board Managers, for construction, heating, etc., of open air pavilion, State Hospital for Care of Crippled and Deformed Children. G. L. Heins, State Arch., Albany, N. Y.

Fort Slocum, N. Y.—Until 10:45 a. m. Oct. 7, by Constructing Q. M., for construction, plumbing, steam heating and electric wiring of the following buildings: Two double barracks, one recruit examination barrack, one Q. M. storehouse, one double set quarters for noncommissioned staff officers, one wagon shed, and one band stand, additions and alterations to mess hall kitchen.

Brooklyn, N. Y.—Until 11 a. m., Sept. 23, by C. B. J. Snyder, Supt. of School Buildings, Park Ave. and 59th St., New York, for completing, heating and ventilating apparatus in public schools 100 and 151.

New York, N. Y.—Until 11 a. m., Sept. 23, by C. B. J. Snyder, Superintendent of School Building, Park Ave. and 59th St., for following work: Installing, heating and ventilating apparatus in P. S. 91, security required, $25,000; installing electric equipment in P. S. 96, security $5,000; installing electric equipment in P. S. 89, Queens Borough; general construction of grand stand, Astoria, Long Island City security $12,000; installing electric equipment in P. S. 28, Richmond Borough.

New York, N. Y.—Until 3 p. m., Sept. 26, by Park Board, 5th Ave. and 64th St., for erection of addition to Metropolitan Museum of Art; security required, $30,000. McKim, Mead & White, Archs., 160, 5th Ave.

Mount Healthy, O.—Until noon, Oct. 5, by Wm. Fischvogt, Clerk Board of Education, Springfield Township, for constructing 2 school houses.

Springfield, O.—Until 3 p. m., Oct. 16, by James Knox Taylor, Supervising Arch., Washington, D. C., for construction complete of extension to U. S. Post Office.

Indiana, Pa.—Until 5 p. m., Sept. 21, by W. F. Elkin, for building for Elks Home.

South Sharon, Pa.—Until 6 p. m., Sept. 28, by A. R. Maxwell, Secretary, for a school building.

Fort Ethan Allen, Vt.—Until 10 a. m. Sept. 28, by Lieut. M. G. Holliday, Q. M., for construction, plumbing, wiring and fixtures for electric lighting, of one brick double set Civilians quarters, at Fort Ethan Allen, Vt.

Milwaukee, Wis.—Until noon, Oct. 21, by Building Committee, Auditorium Board, 45 University Bldg., for constructing auditorium building. Ferry & Clas, Archs., 419 Broadway, Milwaukee.

Manitowoc, Wis.—Until 7 p. m., Sept. 25, by H. L. Markham, Clerk School District, for erection of 6-room school house addition.

Roads and Streets

Bids are asked on following work, the notes being arranged alphabetically by state:

Dubuque, Ia.—Until 8:30 p. m., Sept. 19, E. A. Linehan, City Recorder, for construction, 8 cement sidewalks.

Bluffton, Ind.—Until 7:30 p. m., Sept. 20, by F. S. Smith, City Clerk, for paving West Wiley St., with brick.

Bluffton, Ind.—Until 10:30 a. m., Sept. 26, by Clem S. Brineman, County Auditor, for constructing, 2 gravel roads.

Covington, Ind.—Until 1:30 p. m., Oct. 8, by County Auditor, for constructing four gravel roads.

Greencastle, Ind.—Until 11 a. m., Sept. 28, by C. C. Hurst, County Auditor, for improvement of three macadam roads of total length of 33,406 ft.

Hartford City, Ind.—Until Oct. 7, by L. W. Daugherty, County Auditor, for constructing three macadam roads of total length of 41,425 ft.

Fort Wayne, Ind.—Until 7:30 p. m., Sept. 26, by H. W. Becker, Clerk Bd. Pub. Wks., for grading Beaver Ave. and constructing cement sidewalks; also for paving Knitters Ave. with vitrified paving block.

Indianapolis, Ind.—Until 10 a. m., Sept. 23, by Board Public Works, for 2 contracts for grading and paving sidewalks, 2 contracts for grading and paving roadway, 1 contract for grading and rolling roadway, and 1 contract for resurfacing.

University Heights, Ind.—Until 10 a. m., Sept. 25, by Trustees University Heights, Perry Township, Marion County, for 3 contracts for grading and graveling roadways.

Valparaiso, Ind.—Until 7:30 p. m., Sept. 20, by City Council, for grading, curbing, paving and draining several streets.

Durham, N. C.—Until 3:30 p. m., Oct. 1, by M. G. Markham, County Clerk, for about 11½ miles of macadam road, requiring 60,000 sq. yds. 6 in. macadam, and 75,000 cu. yds. excavation. Gilbert C. White, Engineer.

Richmond, Ind.—Until 10 a. m., Sept. 25, by Board Public Works, for grading, graveling and macadamizing Northwest 2d St.

Fort Williams, Me.—Until 11 a. m., Sept. 21, by Capt. F. J. Morrow, Q. M., 478½ Congress St., Portland, Me., for construction of concrete walks at Fort Williams.

St. Paul, Minn.—Until 2 p. m., Sept. 26, by R. L. Gorman, Clk. Bd. Pub. Wks., for grading Charles St., curbing Goodrich Ave. and grading Valley St.

Kansas City, Mo.—Until 11 a. m., Sept. 26, by E. A. Harper, City Engineer, for 18 contracts for street grading.

New York, N. Y.—Until 11 a. m., Sept. 26, by Louis F. Haffen, President Bronx Borough, 177th St. and 3d Ave., for 19 contracts for paving and street work.

New York, N. Y.—Until 11 a. m., Sept. 30, by Joseph Bermel, President Queens Borough, Long Island City, for 5 contracts for regulating, grading and laying sidewalks.

Syracuse, N. Y.—Until 1:30 p. m., Sept. 23, by George J. Metz, City Clerk, for five contracts for sidewalk construction.

Cleveland, O.—Until 11 a. m., Oct. 5, by Julius C. Dorn, County Clerk, for completion of Miles Ave. improvement. A. B. Lea, County Engineer.

Toledo, O.—Until 10 a. m., Sept. 23, by D. T. Davies, Jr., County Auditor, for repair of Dorr St., stone road No. 34.

Pittsburg, Pa.—Until 10 a. m., Sept. 20, by A. B. Shepherd, Director Public Works, for grading, curbing, paving and repaving with asphalt portion of Center Ave.; also for macadamizing and improving Mansfield Ave. and Hill Road.

Harrisburg, Pa.—Until Sept. 25, by State Highway Department, for construction of roads in North Bellevernon and Rostravor, Westmoreland County.

Fort Sam Houston, Tex.—Until 11 a. m., Oct. 1, by L. J. Fleming, Constructing Q. M., for grading, construction of roads and walks, etc., around new hospital, Fort Sam Houston.

Ogden, Utah—Until 8 p. m., Sept. 23, by A. F. Parker, City Engineer, for paving Wall St.

Harrisburg, Pa.—Until Oct. 10, by State Highway Department, for constructing following roads: Road in North Huntingdon Township, Westmoreland County, 21,538 ft. long, 16 ft. wide; road in Shirley Township, Huntingdon County, 11,445 ft. long, 16 ft. wide; road in German Township, Fayette County, 1 mile long, 16 ft. wide.

Harrisburg, Pa.—Until Oct. 3, by State Highway Department, for constructing following roads: Road in Londonderry Township, Dauphin County, 1 mile long, 16 ft. wide; road in Benton Township, Columbia County, 2 sections, 11,955 ft. and 6,687 ft. long, 15 ft. wide.

Harrisburg, Pa.—Until Oct. 9, by State Highway Department, for constructing following roads: Road in Reynoldsville, Borough, Jefferson County, 1,800 ft. long, 18 ft. wide, of brick and two roads 4,300 ft. and 2,500 ft. long, 22 ft. wide; road in Buffalo Township, Butler County, 13,200 ft. long, 16 ft. wide; road in Winslow Township, Jefferson County, 21,507 ft. long, 16 ft. wide.

Philadelphia, Pa.—Until noon, Sept. 24, by G. R. Stearns, Director Pub. Wks., for paving number of streets.

Kenosha, Wis.—Until 2 p. m., Oct. 7, by R. H. Moth, City Engineer, for street improvement work, including 34,650 sq. yds. brick paving, 17,329 ft. stone curb and 12,175 cu. yds. excavation.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Bisbee, Ariz.—Until 7:30 p. m., Oct. 5, by C. W. Hicks, City Clerk, for constructing sewer system. Plans, etc., with City Clerk. J. L. Campbell, Engr. M. of W., El Paso and Southwestern System, El Paso, Tex., and Olmstead & Gillelan, 616 Grant Bldg., Los Angeles, Cal.

Washington, D. C.—Until noon, Sept. 30, by Jay J. Morrow, Engineer Commissioner, for constructing sewer.

Fort Du Pont, Del.—See Bids Asked—Water Supply.

Des Moines, Ia.—Until 11 a. m., Oct. 1, by Board Public Works, for constructing 10 in. vitrified clay pipe sewer in Tuttle St.

Lima, O.—Until noon, Sept. 19, by L. L. Crumrine, Secy. Bd. Pub. Wks., for grading and 12 in. sewer in North Pawnee St.

Iowa Falls, Ia.—Until Sept. 20, by F. E. Foster, City Clerk, for 1,948 ft. of sanitary sewer.

Fort Madison, Ia.—Until 7:30 p. m., Sept. 23, by W. L. Gerber, Chairman Sewer Committee, for removal and relaying of 24 in. sewer.

Indianapolis, Ind.—Until 10 a. m., Sept. 23, by Board Public Works, for constructing several local sewers.

Richmond, Ind.—Until 10 a. m., Sept. 25, by Board Public Works, for constructing sewer.

Seymour, Ind.—Until 8 p. m., Sept. 30, by Fred Everback, City Clerk, for constructing 4 sewers.

Canton, Miss.—Date for opening bids for sewer system for this place has been postponed from Sept. 19, owing to an unavoidable delay in closing sale of city bonds. New date for opening bids will be announced later. Walter G. Kirkpatrick, Jackson, Miss., is Engineer.

Salem, Mass.—Until 4 p. m., Oct. 2, by Thos. G. Pinnock, Chairman Sewer Commissioners for construction of Secs. 1, 2, 3 and 4 of South Salem trunk sewer, with brick or reinforced concrete. Approximate length of sections is as follows: Sec. ,1 694 lin. ft. of 48-in. sewer, 814 lin. ft. of 42-in. sewer, inverted siphon; Sec. 2, 2,040 lin. ft. of 38in. sewer; Sec. 3, 1,720 lin. ft. of 36-in. sewer, inverted siphon; Sec. 4, 1,645 lin. ft. of 34-in. sewer.

Brooklyn, N. Y.—Until 11 a. m., Sept. 25, by Bird S. Coler, Borough President, for constructing relief sewers in Johnson St., est. cost, $152,904; also for relief sewers in DeKalb Ave., est. cost, $203,132.

New York, N. Y.—Until 11 a. m., Sept. 26, by Louis F. Haffen, President Bronx Borough, 177th St. and 3d Ave, for 8 contracts for sewer construction.

New York, N. Y.—Until 11 a. m., Sept. 30, by Joseph Bermel, President Queens Borough, Long Island City, for 8 sewer contracts.

New York, N. Y.—Until 11 a. m., Sept. 23, by C. B. J. Snyder, Supt. of School Buildings, Park Ave. and 59th St., New York, for general construction, etc., of a sewage disposal plant for the buildings of the Parental School, Flushing, Borough of Queens. Security required is $9,000.

Drayton, N. Dak.—Until 5 p. m., Sept. 30, by L. L. Fairchild, City Auditor, for constructing sewer system. Certified check for $500 required.

Lakewood, O.—Until 11 a. m., Sept. 20, for constructing several sewers. William H Evers Engineering Co., Engineers, 237 The Arcade, Cleveland, O.

Lima, O.—Until noon, Sept. 19, by L. L. Crumrine, Secy. Bd. Pub. Service, for constructing 12 in. sewer.

Steubenville, O.—Until noon, Sept. 30, by T. W. Vance, Clk. Bd. Pub. Service, for constructing sewers.

Wilkesbarre, Pa.—Until noon, Sept. 19, by Fred H. Gates, City Clerk, for constructing several terra cotta pipe sewers.

Woonsocket, R. I.—Until 2 p. m., Sept. 19, by Frank H. Mills, City Engineer, for constructing 900 ft. 8 in. sewer, including 600 cu. yds. rock excavation.

Pittsburg, Pa.—Until 10 a. m., Sept. 20, by A. B. Shepherd, Director Public Works, for constructing 15 in. pipe sewer in Fahnestock Ave. and 12 in. pipe sewer in Fielding Alley and Market St.

Harrisburg, Pa.—Until Sept. 24, by Samuel G. Dixon, Commissioner of Health, for constructing sewer system at State South Mountain Sanitarium. System includes 9,000 ft., 5 in. to 10 in. terra cotta pipe.

Greenfield (P. O. Milwaukee), Wis.—Until 10 a. m., Sept. 21, by Town Clerk, 1315 Forest Home Ave., for laying 600 ft. of sewer.

Milwaukee, Wis.—Until 10:30 a. m., Sept. 19, by C. J. Poetsch, Chairman Bd. Pub. Wks., for constructing sewer in Harrison St.

Water Supply

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Du Pont, Del.—Until 11 a. m., Oct. 10, by Capt. J. L. Knowlton, Constructing Q. M., Fort Du Pont, Delaware City, for remodeling sewer and water systems and constructing 150,000 gallon tank.

Fort Wayne, Ind.—Until Sept. 24, by Board Public Works, for laying 400 ft. 12 in. pipe and 3,600 ft. of 6 in. pipe in Forest Park.

Atlanta, Ga.—Until 4 p. m., Oct. 23, by Park Woodward, General Manager, Water Commissioners, for furnishing and erecting sectional working pressure filter plant of 4,000,000 gallons' capacity.

Iowa Falls, Ia.—Until Sept. 20, by F. E. Foster, City Clerk, for labor of laying three blocks of water pipe.

Primghar, Ia.—Until 8 p. m., Oct. 10, by W. H. Downing, City Clerk, for constructing water works. M. Tschirzi & Son, Engineer, Dubuque, Ia.

Chicago, Ill.—Until 10:15 a. m., Sept. 25, by Ora E. Chapin, Secy. Board Local Improvements, City Hall, for 10 contracts for water supply pipes and one contract for water service pipes.

Beaver City, Neb.—Until Sept. 30, by W. L. Leonard, City Clerk, for furnishing and laying 10,840 ft. of 4 in. cast iron water mains.

Fremont, Neb.—Until Sept 30, by E. N. Morse, Chairman Bd. Pub. Wks., for construction of machinery foundations and erection of chimney at city water and light plant.

Charlotte, N. C.—Until noon, Sept. 19, by Jas. H. Williams, Supt. City Water Works, for laying 1,800 ft. 20 in., 4,150 ft. 12 in., and 250 ft. 6 in. water mains. Bids are also asked for furnishing 440 tons cast iron pipe and specials, 37 Matthews pattern fire hydrants and valves.

Fort Caswell, N. C.—Until 11 a. m., Oct. 9, by L. Cravens, Q. M., U. S. A., for building pump house, ice plant and cold storage plant.

Fort Ethan Allen, Vt.—Until 11 a. m., Sept. 28, by Lieut. M. G. Holliday, Q. M., for piping wells for air lift.

Elkins, W. Va.—Until noon, Sept. 25, by Mayor and City Council, for constructing 1,000,000-gallon reservoir; also for furnishing and erecting about 4,800 ft. of water mains, pumps, boilers, suction pipes and intake water gravity mains. Penniman & Fairley, Engineers, 411 Marine Bank Bldg., Baltimore, Md.

Madison, Wis.—Until Sept. 27, by John B. Heim, Supt. City Water Works, for construction of 1,000,000 gallon concrete storage basin; also for drilling one and possibly two artesian wells.

Milwaukee, Wis.—Until 10:30 a. m., Sept. 24, by Charles J. Poetsch, Chairman Brd. Pub. Wks., for water and sewer connections.

Greenfield (P. O. Milwaukee), Wis.—Until 10 a. m., Sept. 21, by Town Clerk, 1315 Forest Home Ave., for laying 600 ft. of water pipe.

Excavation—Earth and Rock

Bids are asked on following work, the notes being arranged alphabetically by states:

Riverton, Ala.—Excavation, Riprap—Until 11 a. m., Oct. 12, by Maj. Wm. W. Harts, U. S. Engrs., Chattanooga, Tenn., for excavation, riprap and paving at Colbert Shoals Canal, near Riverton.

Washington, D. C.—Dredging, Jetty work—Until noon, Oct. 10, by Maj. Spencer Cosby, U. S. Engrs., 22d and K Sts., N. W., for dredging earth and rock and constructing jetties in James River, Va.

Jacksonville, Fla.—Rock Removal—Until noon, Oct. 10, by Maj. Lansing H. Beach, U. S. Engrs., for dredging and rock removal in Withlacoochee River entrance, Fla.

Jacksonville, Fla.—Dredging—Until noon, Oct. 9, by Maj. Lansing H. Beach, U. S. Engrs., for dredging at Forresters Point, St. Johns River, Fla.

Rockwell City, Ia.—Ditch Work—Until noon, Sept. 24, for constructing 800 ft. of open drain and 5,560 ft. of tile work.

Muscatine, Ia.—Ditch Work—Until noon, Oct. 8, by A. S. Lawrence, County Auditor, for excavating ditches in Drainage District No. 3, requiring 62,870 cu. yds. excavation, placing of additional cast iron pipes at cross levees, and furnishing in place of outlet pipes, masonry and gates at cross levee in Louisa County.

Onawa, Ia.—Ditch—Until noon, Oct. 1, by C. E. Blanchard, County Auditor, for excavation of the McCandlass Ditch, 280,681 cu. yds.

Cerro Gordo, Ill.—Ditch Work—Until noon, Sept. 27, by J. C. Locher, Clerk, for construction of 11 miles of open ditch, involving moving of 210,410 cu. yds. of earth. W. J. Day, Engineer, Bement, Ill.

New Orleans, La.—Levee—Until 11 a. m., Sept. 20, by Capt. J. F. McIndoe, U. S. Engrs., for about 25,000 cu. yds., levee work.

St. Martinville, La.—Canal Work—Contract is to be let shortly by J. G. Broussard, Sec'y Cypress Island Drainage District, for construction of canal to cost about $25,000.

Saginaw, Mich.—Dredging, Filling—Until 10 a. m., Sept. 23, by David C. Bell, Clerk Park and Cemetery Commissioners, for 600,000 cu. yds. excavation and filling.

Vernon Center, Minn.—Ditch Work—Until 2 p. m., Sept. 21, by Fred C. Wilber, Town Clerk, for digging and tiling Ditch No. 1, 1,100 rods long, and averaging 4 ft. in depth.

Charleston, Miss. Ditch Work—Until Sept. 30, by E. Bacon, Secy. Drainage Commissioners, for constructing main ditch 4 miles long, 4 ft. deep and 20 ft. wide, to cost about $14,000.

Miscellaneous

Bids are asked on following work, the notes being arranged alphabetically by states:

Newark, N. J.—Garbage Disposal—Until 3:15 p. m., Sept. 26, by M. R. Sherrerd, Chief Engineer, Street and Water Commissioners, for the collection, removal and disposal of ashes, rubbish material, paper and garbage in the City of Newark for a period of five years beginning Jan. 1, 1908.

San Francisco, Cal.—Wharf—Until 10 a. m., Sept. 28, by Capt. B. F. Cheatham, Constructing Q. M., Fort Winfield Scott, on constructing torpedo wharf.

Chicago, Ill.—Wire and Concrete Fence—Until 10 a. m., Sept. 21, by Special Park Commission, 118 City Hall, for construction of wire and concrete fence around municipal playground, Wrightwood Ave. and Perry St.

Seymour, Ind.—Lighting—Fred. Everback, City Clerk, is desirous of receiving propositions to furnish said city with articficial gas, for light and fuel. Also electric light for street lighting, electric light for private parties and electric power for persons that desire it.

New York, N. Y.—Pier Extension—Until noon, Sept. 27, by J. A. Bensel, Commissioner of Docks, Pier A. Battery Pl., for building extension to pier between 51st and 52nd Sts., Brooklyn. Security required is $8,500.

New York, N. Y.—Track Work—Until 2 p. m., Sept. 26, by James W. Stevenson, Bridge Commissioner, 13 Park Row, for construction and electrical equipment of the subway station tracks and the electrical equipment of the elevated railway tracks of the Williamsburg (new East River) bridge. Security required is $100,000.

New Orleans, La.—Flagstaff—Until 10 a. m., Oct. 7, by Capt. Arthur Cranston, Q. M., U. S. A., for erecting 75 ft. iron flagstaff at Fort Jackson, La.

Toledo, O.—Riprap Wall—Until 10 a. m., Oct. 7, by County Auditor, for constructing riprap stone wall.

Philadelphia, Pa.—Grading, etc.—Until noon, Sept. 18, by W. Hunter, Chief Engr., P. & R. Ry., 520 Reading Terminal, for contract No. 27, grading, drainage and paving for Temporary Freight Yard at Nineteenth and Indiana Sts.

Pittsburg, Pa.—Concrete Steps and Wall—Until 10 a. m., Sept. 20, by A. B. Shepherd, Director Pub. Wks., for concrete steps on Brady St.; also for concrete retaining wall on Bates St.

Newport, R. I.—Ferry Slips—Until 10 a. m., Sept. 24, by Bureau Supplies and Accounts, Washington, D. C., for constructing ferry slips. Schedule 265.

Materials, Machines, Supplies, Tools, Etc

Bids are asked for the following, the notes being arranged alphabetically by states:

Washington, D. C.—Brick, Cement, Machinery—Until 10 a. m., Sept. 24, Bureau Supplies and Accounts, Navy Department, Washington, for furnishing at local navy yard: Gun boring and turning lathe, Schedule 267; brick, sand, Portland cement, broken stone, etc., Schedule 299; copper rivets, etc., tools, backsaw blades, Schedule 304.

Pensacola, Fla.—Cement, Pipe, Drills—Until 10 a. m., Sept. 24, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard: Portland and Rosendale lime cement, gravel, sewer and cast iron pipe, centrifugal pumps, etc., Schedule 287; twist drills, hardware and tools, tool steel, packings, Schedule 288.

Kewanee, Ill.—Pumping Equipment—Until noon, Oct. 5, by J. C. Bannister, Chairman Water Commitee, for furnishing pumping machinery, including steel tower, walking beam, pump rods, power pump, engine, etc.

Fort Caswell, N. C.—Ice Plant.—See under Bids Asked—Water Supply.

Charlotte, N. C.—Pipe, Hydrants.—See under Bids Asked—Water Supply.

New Orleans, La.—Lumber—Until 10 a. m., Sept. 24, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard under Schedule 287 hardware, yellow pine, cypress, etc.

Annapolis, Md.—Bolts, Poles, Pipe—Until 10 a. m., Sept. 24, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at Naval Academy. Schedule 304—Bolts and nuts, files, hand punch and shear, spare parts for engine, parts for hand mowers, hardware and tools. Schedule 305—Chestnut poles. Schedule 306—Bar iron, tool steel. Schedule 307—Miscellaneous packings. Schedule 308—Brass flush pipes, cast iron soil pipe, iron pipe, pipe fittings, expansion joints, cocks, gate, globe and radiator valves, bath boilers, plumbers' supplies.

New York, N. Y.—Steam Hammer, Pipe, Etc.—Until 10 a. m., Sept. 24, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard. Schedule 268—Steam hammer, lift drop hammer, trimming press. Schedule 295—Packing, cast-iron pipe, gate valves, cocks, lead traps, etc. Schedule 296—Electrical conductor, leyden jars, dry cells, receiver sets, insulators. Schedule 297—Small tool machines, brass rod, rolled bronze, steel bar, packings, pipe fittings, rotators for Negus logs, fog horns, megaphones. Schedule 299—Junction boxes, electrical conductor. Schedule 300—Air hose.

New York, N. Y.—Fence, Timber, Etc.—Until 3 p. m., Sept. 26, by Park Board, Arsenal Bldg., 5th Ave. and 64th St., for furnishing following: (1) 10,000 lin. ft. 2-pipe iron fence, (2) timber, (3) topsoil, (4) 3,000 cu. yds. fine bank gravel, (5) 4,000 cu. yds. Hudson River gravel, (6) furnishing and planting trees and shrubs.

New York, N. Y.—Rubble Stone—Until noon, Sept. 23, by Col. John G. D. Knight, U. S. Engrs., Army Bldg., for furnishing rubble stone and quarry spalls for constructing and repairing dikes in Hudson River, N. Y.

League Island, Pa.—Piles, Timber—Until 10 a. m., Sept. 24, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard: Bolts, etc., yellow pine, oak and yellow pine piles. Schedule 295.

Newport, R. I.—Wire Rope, Pipe—Until 10 a. m., Sept. 24, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard. Schedule 299, Gyro testing stands, wire rope, globe valves, iron pipe and fittings. Schedule 302--Mica. Schedule 306—Copper rod.

Charleston, S. C.—Motor Drive, Pipe, Etc.—Until 10 a. m., Sept. 24, for Bureau Supplies and Accounts, for furnishing at local navy yard: Schedule 300—Motor drive. Schedule 302—Copper wire, carbons, electrical supplies. Schedule 304—Wire and sheathing nails, door checks, hardware and tools. Schedule 306—Bar iron, galvanized sheet steel. Schedule 308—Brass and iron pipe, pipe fittings, cocks, valves. Schedule 309—Glass, fire brick, cotton waste.

Norfolk, Va.—Pipe, Gravel, Machinery—Until 10 a. m., Sept. 24, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard: Schedule 268: Sensitive mill, vertical boring and turning mill.—Schedule 304: Vises, hardware.—Schedule 305: Yellow pine.—Schedule 306: Sheet lead, galvanized steel plates, steel plates, billets, angles, channels and bars.—Schedule 308: Terra-cotta pipe, iron pipe and fittings.—Schedule 309: Gravel, steam dry rooms.

CONTRACTS LET.

The following contracts have been let recently:

Birmingham, Ala.—Paving—E. W. Jordan, Birmingham, paving with tarcap macadam and putting in curb and gutters at $160,625.

Van Buren, Ark.—Bridge—The Illinois Steel Bridge Co., Jacksonville, Ill., 100 ft. span steel bridge at $4,600.

Arkadelphia, Ark.—Sewer System—Robinson Bros., Pine Bluff, at $28,363.

New Britain, Conn.—Paving—Warren Bros. Co., Boston, Mass., 3,500 sq. yds. bitulithic.

New Haven, Conn.—Paving—Warren Bros. Co., Boston, Mass., 27,120 sq. yds. bitulithic.

Wilmington, Del.—Bridge—Robert R. Morrison, Wilmington, over Dutch Neck Creek, at $1,262.

Wilmington, Del.—Theobald Tarsch, Nazareth, Pa., 2 miles macadam road, between Christiana and Stanton, at $15,000.

Florala, Fla.—Water Supply—J. M. McCrary & Co., water works system.

Carmi, Ill.—Sewer—Roy P. Winner, Carmi, sewerage extension, at $3,987.

Chicago, Ill.—Paving—The Barber Asphalt Co., asphalt paving on String St., at $15,716.

Chicago, Ill.—Paving—The R. F. Conway Co., asphalt paving on Ruble St., at $15,168.

Rockford, Ill.—Railroad Work—Anderson Bros., Rockford, grading interurban line in Ohio.

Starling, Ill.—Bridges—The Clinton Bridge & Iron Works, Clinton, Ia., 3 bridges at $3,550.

Bluffton, Ind.—Road Construction—J. N. Neff, 4 roads at $15,555; Neff & Ochsenrider, 3 roads at $11,999; Charles North, 5 roads at $26,470; Gordon & Garrett, 4 roads at $16,228; Eli C. Birrie, 3 roads at $16,567; M. J. Kelly, 1 road at $5,233; Amos G. King, 1 road at $2,337; Ulysses Hunnicutt, 1 road at $2,675; and James Parlon of Lafayette, 1 road at $7,700. All to be built of gravel.

Frankfort, Ind.—Paving—The Western Construction Co., Lafayette, 15,000 sq. yds., bitulithic.

Greencastle, Ind.—Road Construction—Enos A. Woods, $2,431; E. Shirley, $2,360; Mahoney & Allen, $3,875; John G. Brown, $5,377. All to be built of gravel.

New Castle, Ind.—Paving—The Western Construction Co., Lafayette, 15,227 sq. yds. of bitulithic.

Atlantic, Ia.—Bridges—Mayo of Omaha, Neb., and Griffith of Des Moines, Ia.

Montezuma, Ia.—Railroad Construction—Donald Fitzgerald, New York N. Y., interurban line from Montezuma to Memphis, Mo.

Davenport, Ia.—Building—The Tri-City Construction Co., brick addition 100 x 200, for Davenport Locomotive works, at $25,000.

Lehigh, Ia.—Building—Johnson & Nelson, Red Wing, Minn., constructing a plant for Lehigh Sewer Pipe & Tile Co., at $200,000.

Halbur, Ia.—Water Supply—Fred Franzwa, Carroll, water works system, at $3,865.

Ames, Ia.—Building—John R. Gier, Conrad, Methodist Church building, at $34,594.

Sioux City, Ia.—Building—Frank Koucher, St. Joseph, Mo., elevator and reinforced concrete warehouse for Sioux City Seed & Nursery Co.

Clinton, Ia.—Building—The Groff & Derr Construction Co., La Crosse, Wis., addition to hospital building, at $25,000.

Onaga, Kans.—Railroad Construction—Kilpatrick Bros., Beatrice, Neb., grading work on the extension of the T. & N. R. R., between Onaga and Marysville.

Alexandria, La.—Sewer—P. H. Porter, Clinton, Ky., West End sewerage extension, at $10,651.

Portland, Me.—Paving—Warren Bros. Co., Boston, Mass., 1,782 sq. yds. of bitulithic.

Baltimore, Md.—Street Work—Patrick Flanagan, macadamizing Chelsea Terrace, at $3,066.

Greenfield, Mass.—Bridge—Peter Barber, Greenfield, reinforced concrete highway bridge over Hinsdale Brook.

Boston, Mass.—Building—Atlas Construction Co., new piggery, at Deer Island, at $4,953.

Boston, Mass.—Excavation—James J. Brock, Charlestown, 300 ft., at 75 cents a foot, for digging dirt and $5 a cu. yd. for rock blasting.

Athol, Mass.—Sewers.—John Guarino & Co., Dorchester, 8,000 ft. of sewers in various streets.

Hibbing, Minn.—Steam Pump—The Prescott Steam Pump Co., at $7,400.

Minneapolis, Minn.—Drainage Ditches—Aspin Bros., constructing 4 drainage ditches, 3 at 15½ cents and 1 at 14 cents.

New Ulm, Minn.—Sewer—Aug. Puhlmann, South Franklin St., sewer, at $2,502.

Durango, Mex.—The Cis Nacaria de Bienes Raices y Ovras Publicas of Mexico City construction of water works system.

St. Joseph, Mo.—Street Work—E. P. Olson, grading King Hill Ave., at 29½ cents per cu. yd.

Warrensburg, Mo.—Bridges—The Midland Bridge Co., Kansas City, 27 steel bridges at a total cost of $14,747.

Norfolk, Neb.—Sewer—John Elsinger, Jr., West Point, constructing sewer district No. 1, at $6,671.

Norfolk, Neb.—Water Supply—O. W. Rish, Norfolk, new water mains at $2,904.

Brown's Mills, N. J.—Bridge—Warner Hargrove, Brown's Mills, at $7,800.

Port Republic, N. J.—Bridge—Joseph P. Brown, Port Republic, across Middle Run, at $1,223.

Plainfield, N. J.—Bridge—Arthur E. Smith, Plainfield, bridge over Rahway River, at $10,455.

Belfast, N. Y.—Railroad Construction—The Patterson Co., Pittsburg, Pa., construction of 3 miles of new main line, requiring about 1,000,000 cu. yds. of excavation.

New York, N. Y.—Bridge—Maryland Steel Co., Baltimore, Queens approach to Blackwell's Island Bridge, at $758,600.

Lockport, N. Y.—Road Work—C. B. Whitmore & Co., Lockport, state road between Lewiston and Dickinsonville.

Albany, N. Y.—Road Work—The Stewart Kerbaugh-Shanley Co., New York City, 14 contracts for state roads at about $435,000.

Monroe, N. Y.—Street Work—The Joseph Sharp Construction Co., Paterson, N. J., cement sidewalks at 20 cents a sq. ft., curbing at 50 cents per lin. ft., driveway and crosswalks at 22 cents per sq. ft., and cobblestone gutters at 10 cents per sq. ft.

Gastonia, N. C.—Paving—The Atlantic Bitulithic Co., Richmond, Va., 10,000 sq. yds., bitulithic.

Charlotte, N. C.—Paving—The Atlantic Bitulithic Co., Richmond, Va., 44,000 sq. yds. bitulithic.

Leipsic, O.—Sewers—F. R. Stone, Lima, at $6,000.

Mansfield, O.—Road Work—MacGledhill, Mansfield, building Climax Pike road at $18,397.

Guthrie, Okla.—Paving—Billings & Snyder, Guthrie, 10 blocks two-course brick paving with sand filler at $1.81 per yd.

Toronto, Ont.—Paving—Warren Bituminous Paving Co., Toronto, 12,147 sq. yds., bitulithic.

Portland, Ore.—Paving—The Warren Construction Co., Portland, 25,814 sq. yds. bitulithic.

Salem, Ore.—Paving—The Warren Construction Co., Portland, 9,277 sq. yds., bitulithic.

Benton, Pa.—Road Construction—G. H. Keiter, Bloomsburg, Columbia County Road.

Earl, Pa.—Road Construction—E. M. Good & Co., Lancaster, Lancaster County Road.

National Road, Pa.—Road Construction—Reed & Patton, Curwensville, Fayette County Road.

Franklin, Pa.—Road Construction—Patrick Ridge, Pittsburg, Greene County Road.

Mill Creek, Pa.—Road Construction—George B. Stucker, Harrisburg, Lebanon County Road.

Reading, Pa.—Paving—Fehr & O'Rourke, vitrified shale block pavement on Fifth St., at $10,977; also vitrified brick on Schuylkill Ave., at $6,678; vitrified shale block on Greenwich St. at $3,539, vitrified shale block on Chestnut St. at $3,756, vitrified shale block on Cotton St. at $9,087, vitrified shale block on 8th St. at $3,280, Samuel Bobst and James Danbrish, granite block påvement on Poplar St. at $3,604.

Bethlehem, Pa.—Sewer—W. H. Stoudt, rebuilding sewer.

Warren, Pa.—Paving—John Mahoney, Jamestown, N. Y.

Scranton, Pa.—Paving—Lee-McDonald Co., paving Washington Ave.

Altoona, Pa.—Power House—Altoona Concrete Construction Co., for Juniata Hydro-Electric Co.

Harrisburg, Pa.—Steam Heating—The York Engineering Co., steam heat plant changes in Capitol.

Claysville, Pa.—Paving—Hallam Contracting Co. at $8,850.

Ridgway, Pa.—Paving—Costello & Nagle, Elmira, Pa., paving Main St.

Altoona, Pa.—Sewers—Saupp & Brhem Altoona.

AD CONTRACTS LET

Allentown, Pa.—School Building—Henry Klase, school building, curbing and paving. W. H. Taylor & Co., heating system at $5,889; J. P. Gallagher, plumbing, at $2,104.

Norristown, Pa.—Grading—Foley & King, grading contract.

Harrisburg, Pa.—Sewers—J. W. McCulloch, sewer contract.

Oakmont, Pa.—Street Work—Sanders Paving & Constructing Co., paving, curbing and grading.

Harrisburg, Pa.—Building—W. S. Roebuck & Co., school building.

Philadelphia (Manayunk Station), Pa.—Electric Light Plant—William H. Dechant, Reading, 100,000 H. P. electric light plant.

Philadelphia (Manayunk Station), Pa.—Building—W. Steel & Sons Co. factory building at $35,000.

Carbondale, Pa.—Heating Plant—Von Beck Bros., heating plant, for city buildings at $1,273.

Baden, Pa.—Sewer—Thomas Sweeney Co., Pittsburg, 18,600 ft. of 15-in., 12-in. and 8-in. sanitary sewer at $10,545.

Providence, R. I.—Road Construction—The following contracts have been awarded:

Coventry, 31,680 ft., John Bristow, $23,-409.90; Gloucester, 10,560 ft., A. W. Steere, $7.-814.22; Gloucester and Burrillville, 5,280 ft., A. W. Steere, $3,819.31; Foster, 5,280 ft. A. W. Steere,$3,970.10; Jamestown, 5,280 ft., Alton Head, $4,784; Lincoln, 3,000 ft., T. J. Quinn, $2,528.50; Little Compton, 5,280 ft., Lane Construction Company, $5,407.55; Narragansett, 7,920 ft., John Bristow, $10,397.60; Portsmouth, 3,000 ft., Lane Construction Company, $5,577.40; Tiverton, 2,640 ft., L. H. Callan, $2,192; Warwick, 15,840 ft., Daniel A. Watson, $2 per cu. yd; Richmond, 5,280 ft, no bid.

PROJECTED WORK.

Railroads.

Items Arranged Alphabetically by States.

Muskogee, Ind. T.—Final surveys are stated to have been completed for the Shawnee Central R. R., Incorporated last May, with $5,000,000 capital stock, to build a 300 mile line from this place, via Shawnee, Okla., to Childress, Tex. It is also stated that construction contracts will be let immediately. Dr. W. S. Woods, President, National Bank of Commerce, Kansas City, Mo., is the chief promoter of the road.

Larned, Kans.—Advices from this place state that the route of the Gulf, Plainville & Northern Ry. has been surveyed from Plainville north to Norton, 60 miles, and that grading has been completed from Plainville to Hobart, 12 miles. The line from Plainville, south to Anthony, 180 miles, is under survey.

Ontonagon, Mich.—The Ontonagon Southern Ry. Co., capitalized at $400,000,000, has filed its articles of incorporation. It proposes to build a railroad, 50 miles long, with Ontonagon as one of its terminal points.

Binghamton, N. Y.—Pittsburg, Binghamton & Eastern R. R. has filed maps and certificates of change of its route. By the change the length of the road in New York state will be about 35 miles, and changes for a considerable distance are also made in Pennsylvania.

Guthrie, Okla.—Denver & Gulf R. R. Co. has filed notice of increase of its capital stock from $2,000,000 to $10,000,000. The road was chartered in Oklahoma, April 24, to build 500 miles of line from Denver, southeast. The contract for 100 miles of grading from Texhoma is stated to have been already let. Robert E. Davis and Wm. R. Evans, Texhoma, Okla., are interested.

SEWERS.

Chicago Heights, Ill.

Sealed proposals will be received by the Board of Local Improvements of the City of Chicago Heights, for the construction of a sewage disposal plant and a system of sanitary sewers, connecting therewith. Said sewers to be constructed in certain parts of the City of Chicago Heights, in accordance with the ordinance providing therefor, and the plans and specifications prepared by the Engineer of said Board, both of which are now on file in the office of the City Clerk of said city.

Bids will be opened by said Board at 8 o'clock p. m. on Wednesday, September 25, 1907. Contractor will be paid in bonds bearing 5 per cent interest payable out of the proceeds of a special assessment levied by the County Court of Cook County to pay for said improvement (Docket No. 13, Chicago Heights).

All proposals or bids shall be accompanied by cash or a check payable to the order of the President of the Board of Local Improvements in his official capacity, certified to by a responsible bank, for an amount which shall not be less than 10 per centum of the aggregate of the proposal.

Bids will be received until 7 o'clock P. M. on September 25, 1907. They must be made on proposal forms to be obtained of the Engineer in charge and be sealed and marked, "Proposals for Sewage Disposal Plant and Sanitary Sewers," and addressed to John Gravelot, Clerk of the Board of Local Improvements of the City of Chicago Heights, Illinois.

BOARD OF LOCAL IMPROVEMENTS,
CITY OF CHICAGO HEIGHTS, ILLINOIS.
By L. H. HOOK, President.
Dated September 11, 1907. 12-1t

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NOTICE TO BRIDGE CONTRACTORS FOR BIDS.

Sealed bids will be received by the Board of County Commissioners of Neosho County, Kansas, at the office of the county clerk of said county, up to 12 o'clock on Tuesday, October the 15th, 1907, for the construction and erection of three all steel or iron bridges, to be erected across the Neosho river, in Neosho County, Kansas, to be as follows:

One 200 foot span, one 70 foot span, two 30 foot I-beam approaches, 20 foot roadway, 4 54-inch tublers 40 feet high, two 36-inch tublers 25 feet high, concrete abutments for approaches; said bridge located one mile east of Chanute, Kansas.

One 200 foot span, one 75 foot span, one 30 foot I-beam approach, 14 foot roadway, 4 48-inch tublers 38 feet high, concrete abutments for approaches; said bridge located 2½ miles west of Erie, Kansas.

One 200 foot span, one 50 foot span, one 30 foot I-beam approach, 14 foot roadway, 4 48-inch tublers 39 feet high, concrete abutments for approaches; said bridge located one mile south of St. Paul, Kansas.

Also repair of one bridge on Flat Rock Creek, 5 miles east of Kimball, Kansas.

Also one 30 foot I-beam for bridge 7 miles southeast of Thayer, Kansas.

All bidders must deposit a certified check of one hundred dollars, with bid which will be forfeited by the successful bidder if he fails to contract and furnish bond required within ten days.

The board reserves the right to reject any or all bids.

All plans and specifications on file in the office of the county clerk, at Erie, Neosho County, Kansas.

Dated at Erie, Kansas, September 4, 1907.
H. LODGE, Chairman.
Attest: O. M. JOHNSON,
(Seal) County Clerk. 12-1t

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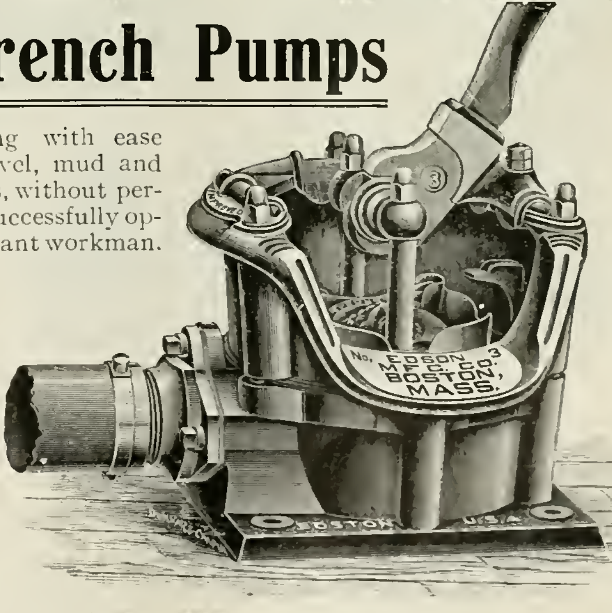
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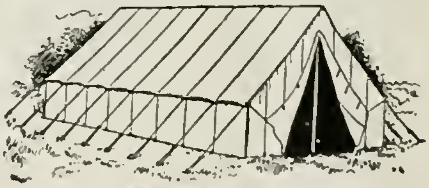

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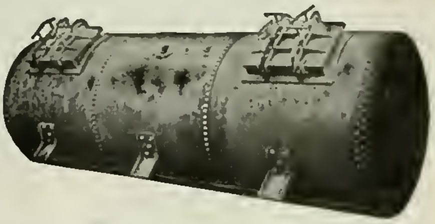

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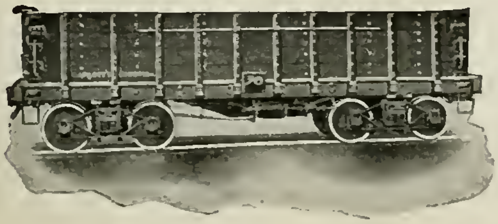

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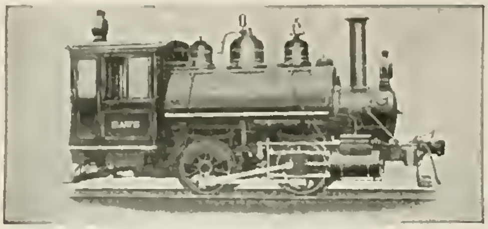

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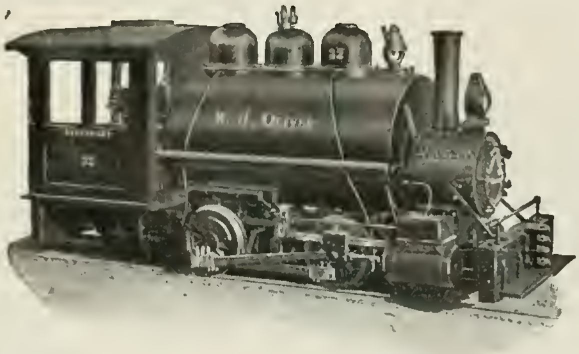

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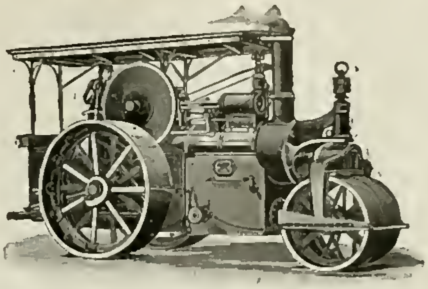

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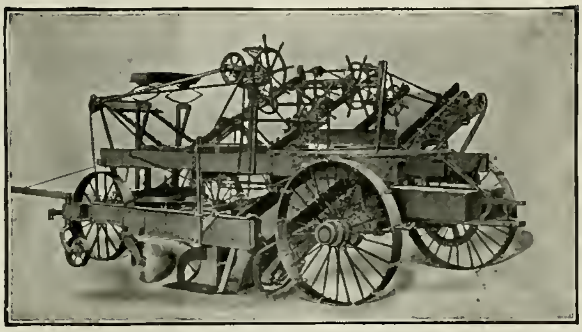

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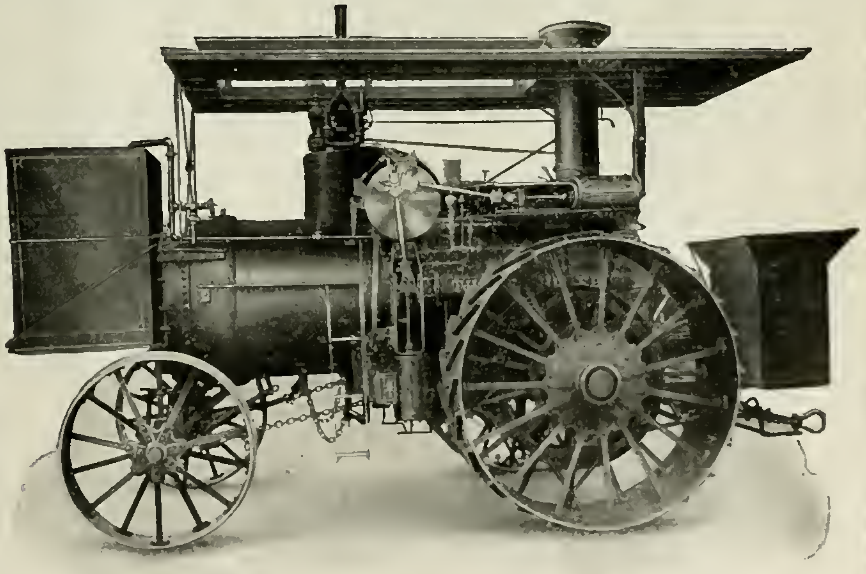

shown in the New Huber Contractor, is a proved success. The wide, high drive wheels and the high steel cleats enable the engine to get a grip on the ground that will stand an enormous pulling strain. No matter what twisting or side strain there may be, the driving mechanism can never get out of line. The cylinder, guides and bearing are cast in one piece and bored at one setting, insuring constant, perfect alignment.

The Compensating Gear is composed of all-steel spur gear and pinions and is enclosed between two steel plates, keeping it free from sand and dust. The purpose of this device is to allow one drive wheel to revolve independently of the other when needed, and is thrown in and out by a foot lever from the platform.

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Eighty Applications for Membership in Am. Soc. Eng. Contr. Received Last Two Weeks.

During the last two weeks 82 applications for membership in the American Society of Engineering Contractors have been received. One of the gratifying features, aside from the interest thus shown in the society, is the fact that nearly half the applications came from civil engineers. We have said several times, and we repeat, that one of the primary objects of this society is to provide a forum where contractors and engineers can discuss matters of mutual interest.

To that end it is essential that engineers join the society, and we are glad to note the fact that they are joining.

Another reason why many engineers will find it to their interest to belong to the society is this: Contractors are learning that an engineer who has made a study of cost analysis is a very valuable man not only in preparing bids but in reducing costs after contracts have been awarded. The idea that engineers are capable only of designing structures and setting stakes is fast vanishing. In consequence a large field of activity is open to engineers either as salaried employes of contracting firms or as members of such firms. By joining the American Society of Engineering Contractors, an engineer has an opportunity to come in touch with contractors and to make known his qualifications as a cost analyst, as a designer of plants for special purposes, and as an organizer and manager generally. We anticipate that the papers presented at meetings of this society will come largely from engineers and will serve to advertise the authors of the papers as being practical men.

We anticipate that the society will become the largest technical society in the world, and one of the most influential. The dues should always remain nominal, for, with a large membership, a small contribution from each member will suffice to print the transactions and cover the fixed expenses of the organization.

Can't we open the year 1908 with 1,000 charter members? To those who have already made application we have suggested the plan of calling the attention of some friends to the half page application blank to be found on one of our advertising pages, with a request to join the society. Many of the applications received thus far have been secured in this way. Hundreds more can be secured in like manner by this endless chain plan.

A Plan for Building the Panama Canal by Short Time Contracts.

For the consideration not only of the chief engineer of the Panama Canal, but for the consideration of all engineers having large or difficult jobs to handle, we wish to submit a plan which may be termed The Short Time Contract Plan of Doing Public Work.

Its essential features are these: The government furnishes the entire plant and materials with which to perform the work. The contractor furnishes all the labor and enters into a contract to perform the work at the unit prices named in his sealed bid. A contract is awarded, not for performing all the work, but only for such a number of units of work as can be completed within a given time, say 12 months, with the plant that is furnished.

Thus, assume there are 10,000,000 cu. yds. to be excavated on a given section of the work and that a plant will be provided with which at least 2,000,000 cu. yds. can be handled in 12 months. Under the proposed form of contract the contractor would receive his unit price for these 2,000,000 cu. yds., new bids would be called for on the second 2,000,000 cu. yds.; or, if desired, a larger quantity would be covered by the second contract. In any event, at comparatively short intervals of time new contracts would be awarded for a continuation of the same work.

Let us consider the advantages and disadvantages of this plan. First, as to the disadvantages.

A contractor likes to be assured of a long continuance of any profitable work, uninterrupted by delays, for he can secure and organize his force to better advantage when he can assure the men of long service.

A contractor can bid lower on work that is to be long continued, for he can afford to secure a larger plant and be assured of having enough work to keep it busy long enough to recompense himself for the outlay.

These, we believe, are the two strongest objections that can be offered against short time work. But it is evident that the second objection disappears entirely where the government furnished the plant, leaving only the first objection. This, too, it seems to us, has very little weight where the work is to last more than six months or a year; contractors' employes are not accustomed to uninterrupted service anyway. Be that as it may, the advantages of the Short Time Contract Plan far overbalance the disadvantages when the net result is set alongside the result obtained where contract work is abandoned entirely, as is the case on the Panama Canal at present.

Under a short time contract the contractor runs no such risk of ruin as would be run under a long term contract involving many times as many units of work. He is, indeed, like the boy who would not engage to lead a herd of pigs, one by one, to market until he had tried the leading of one.

Having completed the first contract at a loss, the contractor will bid higher on the second, it is true. But who wishes to ruin any man? On the other hand, if the first contract yields an excessive profit, the contractor will bid lower on the second contract for fear of losing it to some competitor.

So far as the Panama Canal is concerned, a contractor will run scarcely any risk at all in the first bidding, because every contractor knows that he can do the work for much less than it is costing the government. Let the government make public its itemized cost records, and it will furnish a safe guide for bidding.

Being free of the burden of furnishing

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an enormously expensive plant, the contractor has only to raise enough money to pay his men for one month, provided monthly estimates are made promptly, and for the full amount of the work done. On work of great magnitude it is an injustice and a short sighted policy to hold back even 10 per cent of the contractor's monthly estimate. The bond alone should be sufficient to insure faithful performance. In fact it would not be impracticable to pay the contractor every two weeks, if a few more engineers and clerks were employed to compute the quantities, and if some red tape were dispensed with. Thus the capital required to handle the work would be reduced so that there would be plenty of competition in bidding.

Some engineers seem to have acquired an aversion to the letting of contracts in sections, in the face of the fact that contractors themselves are given to subletting work in sections, and find it profitable to do so. Therefore some engineers will likewise object to the short time contract, not because it is impracticable but because it means the doing of the work in sections. However, objections may be heaped knee deep over this plan, yet a whiff of logic will blow them away, whereas no logic can be found to defend the wasteful plan of doing public work by day labor.

We hear much of the wonderful amount of dirt moved last month at Panama. Who has heard anything as to the unit cost of moving it? It is not Goethal's fault that it is expensive work—unreasonably expensive. He can not make over human nature. Men simply will not sweat for Uncle Sam, who is rich and can foot the payroll bill—particularly when Uncle Sam is the butcher, the baker, the candle stick maker, who never sees the bill at all and must pay it anyway, unsight and unseen.

It is a pity that Congress did not stipulate some sort of a contract under which to build the Panama Canal. Even the freak contract devised by Stevens was far superior to the day labor system.

Major Goethals has a great chance to win such fame for himself as no continuance of the present plan can possibly bring him, and that chance, we believe, lies in adopting the Short Time Contract Plan He has shown already that he is the equal, if not the superior, of his predecessors as an engineer. He now has an opportunity to prove that he is as broad minded as he is energetic, and he can show that broadness only by abandoning the endeavor to be engineer and contractor welded into one.

During 1906 the increase in mileage of the railways of India was 792 miles, which makes a total of 29.097 miles, made up of 15,548 miles of standard gauge (5½ ft.), 12,149 miles of meter gauge (3 ft. 3⅜ in.), and 1,400 miles of special gauge (2 and 2½ ft.).

Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

The Equipment and Work of the U. S. Government Concrete Testing Laboratory at St. Louis, Mo.

BY RICHARD L. HUMPHREY,* M. AM. SOC. C. E.

The increased use of concrete in many forms during the past few years, especially for building purposes, has created a great demand for information regarding the structural value of this material. For a number of years limited investigations designed to obtain this information have been carried on by a number of investigators throughout the country, but no serious attempt at co-operation in this work had been made until a few years ago, when the United States Geological Survey, recognizing the need of information and co-operation, procured a small appropriation for making tests of structural material and invited various technical societies to take part in the work.

A committee called the Joint Committee on Concrete and Reinforced Concrete was invited to assist in outlining the work at the laboratories. This committee is composed of members of the American Society of Civil Engineers, the American Society for Testing Materials, the American Railway Engineering and Maintenance of Way Association and the Association of American Portland Cement Manufacturers. The leading professors of engineering from almost all of the large colleges in the country are members of this committee, and they and an advisory board composed of leading engineers throughout the country have general supervision of the work.

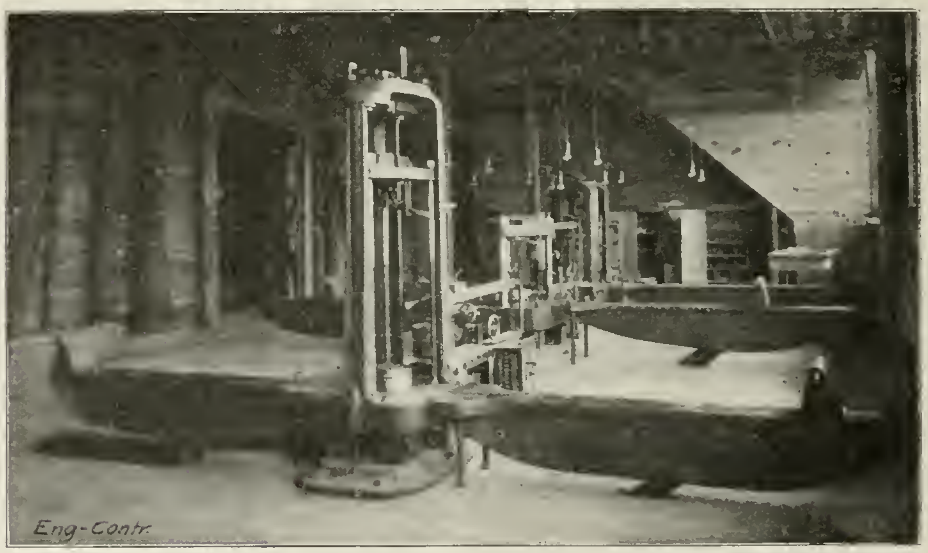


Fig. 1.—Beam Testing Machines, U. S. Concrete Testing Laboratory.

Tests are being carried on to determine the value of different sands, stones, and other materials used in the manufacture of concrete. The material is shipped from all parts of the country by geologists connected with the work and a complete record of the material is sent in by them. At the laboratories this material is made into mortar and concrete by using the different percentages ordinarily employed in practical work and following as closely as possible practical conditions.

In addition to the study of the constituent materials of mortars and concretes, structures of various kinds similar to those used in buildings are made and tested. The equipment of the laboratories at St. Louis for carrying on this work is very complete. In addition to all needed smaller apparatus there are four testing machines of 200,000-lb. capacity and one of 100,000-lb. capacity, suitable for testing beams and other structures used in buildings. These machines will test beams up to 20 ft. in length and are equipped to make tests of the different materials used in construction work. Three of these machines used in the beam division are shown in Fig. 1.

---

*Engineer in Charge, Structural Materials Division, U. S. Geological Survey, St. Louis, Mo.

In addition to the above machines a very large machine, having a working capacity of 600,000 lbs., will in a few weeks be installed. As far as known at this time there is only one other machine in the United States similar to this. This machine will make it possible to test columns, beams, and in fact all the different kinds of construction material now used. It will test very large reinforced concrete girders up to spans 30 ft. in length and concrete columns up to 30 ft. in length.

The value of such tests as these is readily apparent, since their results can be applied directly to practical work. A very serious objection to the use of results obtained in tests made by private investigators is due to the fact that the tests were applied only to small specimens not nearly approaching in size the parts or pieces used in actual construction. Heretofore it has been necessary to consult the results of these small tests in order to have some basis for design, but it is now clearly recognized that the best results can be obtained only from tests made on members as large as possible, or at least on pieces as large as those ordinarily used in structural work.

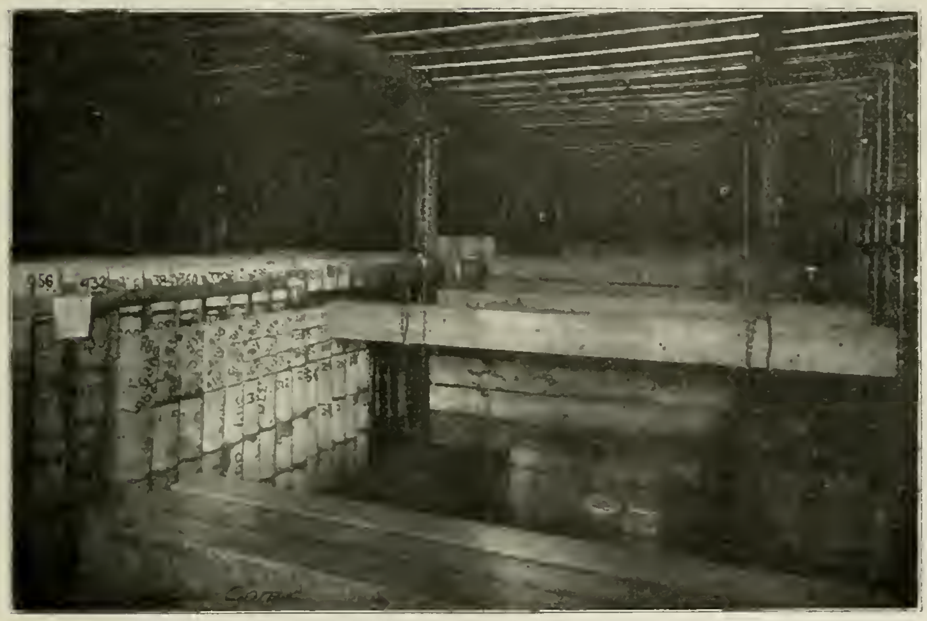


Fig. 2.—Storage Room for Test Specimens, U. S. Concrete Testing Laboratory.

All the concrete used at the laboratories is mixed in three Chicago improved cube concrete mixers, each of which is mounted on skids, geared to a motor and equipped with charging hopper. One of these mixers has a capacity of 1 cu. yd. and the others will contain 1-3 cu. yd. each. After the concrete is mixed it is carefully tamped in molds to form the different pieces on which the tests are made, such as cylinders, cubes and beams.

The laboratory also uses five hollow concrete block machines, for making concrete blocks similar to those used in actual construction, and the several different divisions—the constituent materials division, the beam division, the concrete block division, the permeability, the shear and tension and the chemical division are equipped with all apparatus necessary for conducting their tests.

The longest beam thus far tested has been 13 ft. in length. Beams of this length tested are made without steel, that is, of solid concrete, and also with varying proportions of steel, ranging from very small percentages up to 3 per cent. The men conducting the tests watch the beam very closely while it is in the testing machine, and examine its surfaces with magnifying glasses in order to locate the fine cracks as they appear. In the begininng a load of about 5,000 lbs. is applied and the machine is stopped with this load on the beam. After the observers have examined the beam carefully and made a record of the cracks appearing at that time, the load is increased and after every 1.000 lbs. additional the beam is again examined until the maximum load is applied. In a very large number of tests the beam shows no cracks that are visible to the eye until the maximum load is reached, when the steel reaches its elastic limit and begins to stretch fast, this result ending the test. The cracks that appeared on the beam and the loads at which these cracks appeared are recorded by photographs.

In beginінng tests of reinforced concrete simple round rods were used, as it was thought that more uniform results could thus be had than if any of the patented systems were used. After a complete series of tests with the round rods has been made, it is proposed to take up tests of the different forms of bars that are used in practical work, and the results will be published from time to time. Tests will be made of beams ranging from 6 to 12 ft. in length, and beams of longer span will be tested later, if necessary, in order to get results that can be applied to almost all practical conditions.

The concrete used in the different beams tested, as described above, is molded into cylinders and cubes, which are tested in order to get the direct strength of the concrete. These cylinders and cubes are tested at different ages, generally at ages, 7, 28, 90, 180 and 360 days. The cement, sand, stone, gravel, or other material composing the concrete is carefully proportioned by weight, the correct percentage of water is used and the whole mass is placed in a mixer and thoroughly mixed. It is then deposited very carefully in molds or forms which after 24 hours, are removed. The concrete is then moved into a storage room, shown in Fig. 2, and is there sprinkled with water three times each day. Each test piece is numbered on a card index, which tells where information relating to the test pieces can be found and also indicates the dates on which the different pieces are to be tested.

A branch of the work that should be of interest to everybody, especially the small home-builder, is the investigation of cement building blocks. All the cement blocks used in these investigations are made in concrete block machines. The concrete is mixed in a 1-3 cu. yd. cubical concrete mixer and deposited on the floor of the testing room. It is then shoveled into the hollow block machines and compacted very firmly in the forms. Varying proportions of concrete, sand, and stone are used in order to determine the relative value and economy of using different mixtures. Some blocks are made of wet concrete, others of concrete very dry, and still others of concrete having a consistency medium between wet and dry. When the concrete blocks are removed from the forms they are placed in the storage room and tested at different ages. The storage room used for concrete blocks is similar to that shown in Fig. 2. Cylinders are also made from the same concrete that is used in the blocks, and the results of tests of the cylinders and of the blocks establishes a relation between the strength of the concrete in the cylinder and that of the concrete in the block.

When the blocks and cylinders are placed in the storage room, each test piece is numbered and its number is filed away on a card in a card index. Each card bears the date on which the test piece is to be tested and the cards are filed in chronological order. This brings the current date at the front of the drawer each morning, when cards bearing the same date are taken out and the pieces are taken from the storage room and tested. The results are compiled on forms and later published in reports issued by the Geological Survey.

Concrete blocks are tested, first, to see how much of a center load each block will stand. Although blocks are not actually subjected to a load of this kind in practice, the results of this test make it possible to compare the relative values of different building blocks. Second, after the block has been broken at the center, each half is placed in the testing machine and crushed, in order to find the crushing strength of the block. The results of this crushing test show how much pressure similar cement blocks will stand when used in actual building construction.

A series of fire tests is being carried on by the Geological Survey at the Fire Underwriters' Laboratory at Chicago. For this purpose a hanging door having a steel frame and a one-foot wall of fire brick inside of it is used. At the center of this frame there is an arched opening of about the size of an ordinary door. For the fire tests this opening is built up successively with different materials, ordinary building brick, fire brick, hollow tile blocks, the different kinds of cement building blocks, stone, concrete and terra cotta. After the opening is filled, a flaming gas jet is played all over the door for a long time and when the heated surface is very hot, the gas is turned off and the door allowed to cool. In some tests the cooling takes place slowly, in others a stream of water is played on the door immediately after the gas is turned off in order to reproduce as nearly as possible the actual conditions in a fire.

When these tests are completed, the results will not only show engineers and architects what material is best for fireproofing and how much should be used to procure the best results, but will also teach the small builder, the builder of a home, what kind of a cement block is best adapted to make his house fireproof.

Cost of Mixing and Placing Concrete for a Retaining Wall.

In a paper describing the work of track elevation in Allegheny, Pa., and published in the Proceedings of the Engineers' Society of Western Pennsylvania, Mr. H. S. Wilgus, engineer in charge, gives some interesting costs of mixing and placing concrete for a retaining wall. The wall was 6,100 ft. long and about 75 per cent of the length was on curves. The first wall built had a width of base 0.4 of the height of the real work and a width of top of 2½ ft., the back being a smooth batter. Later the back was stepped and last the wall was proportioned as follows: Calling the height of wall from top or foundation to under coping h, then width of base equaled 0.45 (h+3) the top measuring 2½ ft. The rear was arranged in steps 24 ins., 30 ins., and 36 ins. high, and the thickness of wall at each step was, calling h equal to height of step from base, 0.45 (h+3).

Both Portland and natural cement concrete was used mixed fairly wet with gravel as the aggregate. The natural cement concrete was a 1-2-5 mixture and the Portland cement concrete was a 1-3-6 mixture.

Both hand and machine mixing was employed. In hand mixing the sand and gravel were measured in wheelbarrows and wheeled onto the platform; the sand and cement were spread in thin layers one over the other, and thoroughly dry mixed; the gravel was then spread over the mixture; the whole shoveled into barrows or the pit, again shoveled into place and rammed.

For machine mixing a cubical mixer was used. A charging box of 1¼ cu. yds. capacity, graduated to show the correct proportions of sand and gravel, was filled by shoveling; cement was placed on top and the box then hoisted and dumped into the mixer. A barrel holding the correct amount of water was emptied into the mixer which was turned 10 or 15 times and discharged into cars.

The concrete was laid in 8-in. courses. For exposed work the concrete was faced with a 1-2 Portland cement mortar. The forms were made of 2-in. planed white pine, the rough edges being jack-planed. Soft soap was applied to the face of the forms. After the forms were removed board marks and other defects were removed and a wash of neat cement was applied.

Several forms of expansion joints were tried. The first was tarred paper extending through the walls every 50 ft. The second was ½-in. boards running through the wall every 50 ft. The third was a ½-in. board extending 2 ft. into the walls with a ¼-in. cove at the angles, the idea being that the interior concrete remained at a constant temperature, the face above expanding and contracting. These joints were placed every 25 ft. and gave perfect satisfaction.

One contractor used hand mixing exclusively and the other used the cubical box mixer, and the following records of cost of the two methods of mixing were obtained:

Hand Mixing.	Total	Per cu. yd.
½ foreman at $3	$ 1.50	$0.025
3 men wheeling barrows at $1.50	4.50	0.075
10 men wheeling materials at $1.50	15.00	0.250
3 men mixing sand and gravel at $1.50...........	4.50	0.075
6 men mixing concrete at $1.50	9.00	0.150
1 man sprinkling at $1.50..	1.50	0.025
Total	$36.00	$0.600

The output of the hand mixing gang was 60 cu. yds. per day.

Machine Mixing.	Total	Per cu. yd.
1 foreman at $3.50.........	$ 3.50	$0.035
1 stationary engineer at $3..	3.00	0.030
½ foreman at $1.75.........	0.87	0.009
15 men loading charging bucket at $1.50...........	22.50	0.225
2 men dumping charging bucket at $1.75...	3.50	0.035
2 tagmen at $2, ½ time....	2.00	0.020
1 man at trap at $2, ½ time	1.00	0.010
Total	$36.37	$0.364

The output of the cubical mixer was 100 cu. yds. per day.

The costs of placing concrete in the forms above the foundation by hand below 12 ft., and by cars and derricks any height were as follows:

By Hand (Barrows) Below 12 ft.:

	Total	Per cu. yd.
4 men loading concrete at $1.50	$ 6.00	$0.100
1 foreman ½ time at $3....	1.50	0.025
10 men wheeling at $1.50....	15.00	0.250
1 man scraping barrows at $1.50	1.50	0.025
2 men placing concrete at $1.50	3.00	0.050
1 man placing mortar face at $1.50.................	1.50	0.025
2 men mixing and carrying mortar at $1.50...........	3.00	0.050
Total	$31.50	$0.525

By Cars and Derricks:

	Total	Per cu. yd.
1 horse and driver at $3....	$ 3.00	$0.030
2 men dumping concrete ½ time at $1.50.............	1.50	0.015
1 fireman ½ time at $1.75...	0.88	0.009
3 tagmen at $1.50	4.50	0.045
8 men placing and ramming conc. at $1.50.......	12.00	0.120
2 men mixing mortar at $1.50	3.00	0.030
2 men placing mortar at $1.50	3.00	0.030
2 men carrying mortar at $1.50	3.00	0.030
1 foreman at $3	3.00	0.030
1 stationary engineer at $3.	3.00	0.030
2 men attending hook at $1.50	3.00	0.030
Total	$39.88	$0.399

The costs of placing concrete in the foundations were as follows:

By hand:	Total	Per Cu. Yd.
1 foreman ½ time at $3.....	$ 1.50	$0.025
4 men shoveling concrete at $1.50	6.00	0.100
1 man plac'g concrete at $1.50	1.50	0.025
1 man ram'g concrete at $1.50	1.50	0.025
Total	$10.50	$0.175
By machine:		
1 horse and driver at $3.....	$ 3.00	$0.030
3 men pushing and unloading car at $1.50..............	4.50	0.045
5 men placing and ramming at $1.50...................	7.50	0.075
1 foreman at $3.............	3.00	0.030
2 men dumping mixer at $1.50	3.00	0.030
Total..................	$21.00	$0.210

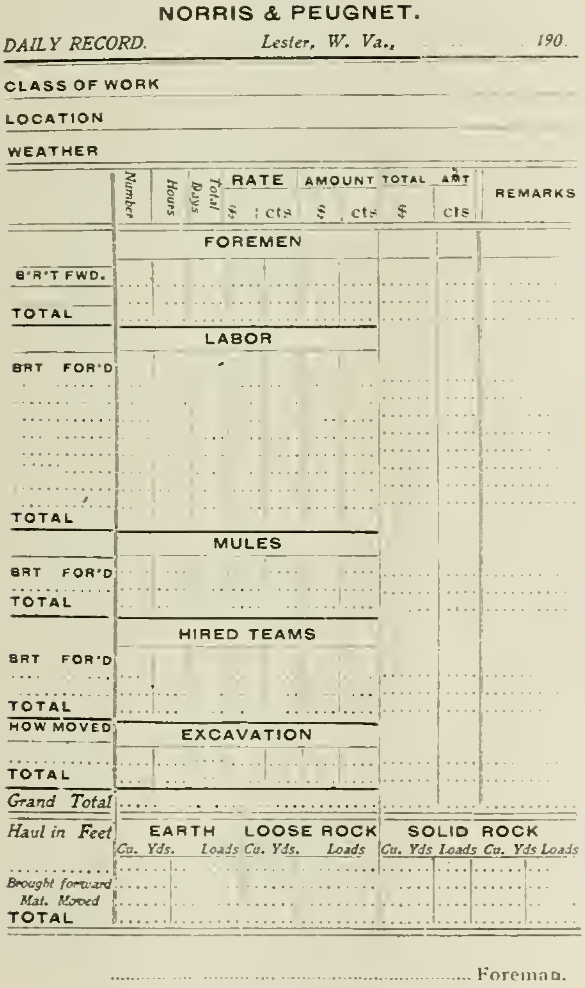
Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Cost Keeping on Railroad Construction

In railroad construction it is more difficult to secure proper supervision of workmen than on many other kinds of engineering jobs. This is due to the fact that the men are distributed along the line of the road, a contractor's forces being scattered over many miles. Under such circumstances the keeping of cost records of work done is essential to efficiency.

Figs. 1 and 2 show two daily reports for open cut work. They both go somewhat into details, but No. 2 more so than No. 1. The latter has no spaces for explosives, blacksmith or feet of holes drilled, while No. 2 has spaces for these.



NORRIS & PEUGNET.

DAILY RECORD. *Lester, W. Va.,* *190.*

CLASS OF WORK

LOCATION

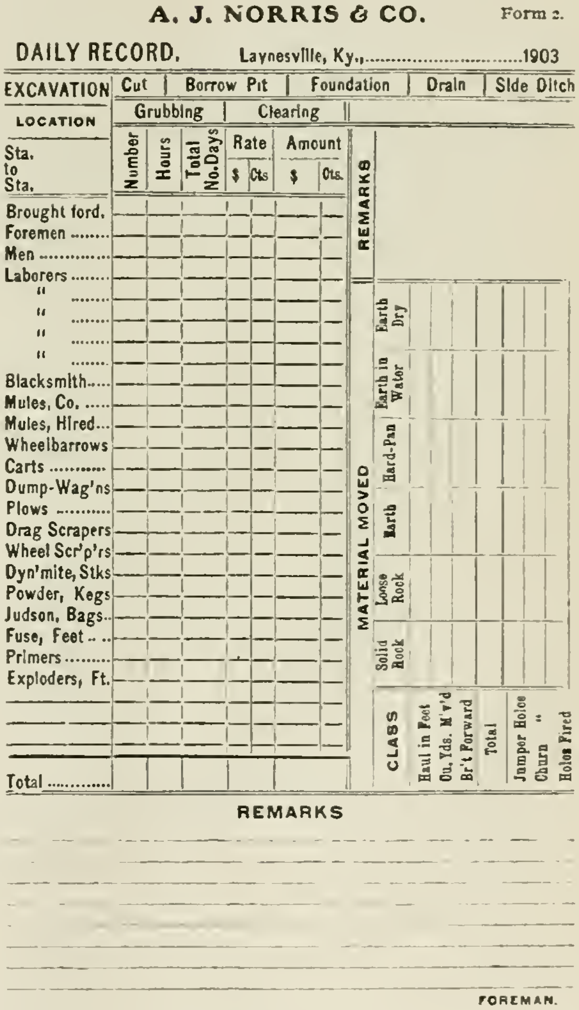
WEATHER

	Number	*Hours*	*Total Days*	RATE $	cts	AMOUNT $	cts	TOTAL AMT $	cts	REMARKS
	FOREMEN									
B'R'T FWD.										
TOTAL										
	LABOR									
BRT FOR'D										
TOTAL										
	MULES									
BRT FOR'D										
TOTAL										
	HIRED TEAMS									
BRT FOR'D										
TOTAL										
HOW MOVED	EXCAVATION									
TOTAL										
Grand Total										

Haul in Feet	EARTH *Cu. Yds.*	*Loads*	LOOSE ROCK *Cu. Yds.*	*Loads*	SOLID ROCK *Cu. Yds*	*Loads*	*Cu. Yds*	*Loads*
Brought forward								
Mat. Moved								
TOTAL								

Foreman.

Fig. 1.—Cost Keeping on Railroad Construction—Form for Daily Report.



A. J. NORRIS & CO. Form 2.

DAILY RECORD. Laynesville, Ky.,1903

EXCAVATION	Cut	Borrow Pit	Foundation	Drain	Side Ditch
	Grubbing	Clearing			

LOCATION Sta. to Sta.	Number	Hours	Total No. Days	Rate $	Cts	Amount $	Cts.
Brought ford.							
Foremen							
Men							
Laborers							
"							
"							
"							
"							
Blacksmith							
Mules, Co.							
Mules, Hired							
Wheelbarrows							
Carts							
Dump-Wag'ns							
Plows							
Drag Scrapers							
Wheel Scr'p'rs							
Dyn'mite, Stks							
Powder, Kegs							
Judson, Bags							
Fuse, Feet							
Primers							
Exploders, Ft.							
Total							

REMARKS

MATERIAL MOVED							
Earth Dry							
Earth in Water							
Hard-Pan							
Earth							
Loose Rock							
Solid Rock							
CLASS	Haul in Feet	Cu. Yds. M'v'd	Br't Forward	Total	Jumper Holes	Churn "	Holes Fired

REMARKS

FOREMAN.

Fig. 2.—Cost Keeping on Railroad Construction—Form for Daily Report.

These reports are made out by each foreman for the gang working under him, and a contractor should have but little trouble in judging quickly if any one gang is not being handled properly.

Figs 3 and 4 are blanks for making a monthly resume of the daily reports. The value of the foreman's estimate of the amount of work done during the month on the form in Fig. 4 is questionable. It is the engineer's estimate that counts. The foreman's estimate, even if made with sincerity, is more than apt to be influenced by his desire to get a large amount of work done, in order to make a good showing for himself.

These sheets are printed on manila cardboard and Figs. 2 and 4 are reproduced natural size, while Figs 1 and 3 are slightly reduced. The first set was used on the Big Sandy extension of the Chesapeake and Ohio R. R., while the other set was for use on the Deepwater Ry.

The last sheet shown on pages 182 and 183 is a record of labor on tunnel construction only. The sheet was 11 x 21½ ins. The part reproduced shows day shift only, but on the original sheet by the side of the day shift was a reproduction of the same form for a night shift, the only variation being that as the stone quarry was run during the day only, this did not appear in the night shift's report. The form is large and rather cumbersome and does not show details of progress of the work.

All these forms are subject to the criticism that the reports can not be made in duplicate in carbon copies. This is an important feature in cost keeping, for obvious reasons.

Glenfield tunnel, on the Leicester & Swannington, a part of the Midland Railway system of England, is said to be the oldest railroad tunnel in the world. It is about a mile long. Only four passenger trains pass through the tunnel each week day, and from Saturday night until Monday morning it is closed by a padlocked door at either end.

An Improvement in Plug Drills.

In a paper presented before the Engineers' Society of Western Pennsylvania by Chester B. Albree, president of the Chester B. Albree Iron Works, of Allegheny, Pa., Mr. Albree tells of an improvement made by their company in pneumatic hammers. As these tools are used by quarrymen and contractors, under the name of plug drills, we abstract the following from this paper:

"We have been working on pneumatic hammers and have now perfected a hammer one or two features of which are novel and of interest. In pneumatic hammers of nearly all makes, one of the sources of trouble has been that if the workman picked up the hammer and put his finger on the trigger when there was no chisel or rivet set in, the piston would begin to reciprocate, and not having any tool to strike at the lower end it would strike the cylinder head, and in a matter of a minute or two it would smash the piston or cylinder. About 75 or 80 per cent of the breakages of pneumatic hammers are due to the carelessness of workmen in pressing on the trigger when there is no work to do. We have devised a method of obviating this trouble which is very simple.

"The admission port is located near, but not at, the end of the larger cylinder bore. When no tool is placed in the end of the hammer the lower end of the large piston diameter passes and closes the admission port, thus preventing air from acting upon the differential area to lift the piston. Any compressed air below the large diameter escapes by a small leakage port to the exhaust; and this leakage port is open only when the admission port is closed. In hammers actuated by valves exterior to the piston, it seems impossible to use this device, and attempts have been made to mechanically close such valves, but they do not appear to be very successful. The same effect is obtained, but at the expense and loss of air, when the leakage port is designed to open when the piston is at the extreme end of the stroke, but does not close the admission port. Patents are now pending for these improvements.

"This simple device is very effective. We can pick up a tool and with 100 pounds air pressure in the pipe, put our finger on the trigger, open the throttle, and it does not start unless the tool is fully in place, whereas, with any other that I know of, the moment you put your finger on the trigger it begins to work, and it is only a matter of a few minutes until it is good for nothing."

The Standard Dredging Co., Baltimore, Md., has been awarded a $803,000 contract for deepening approaches to and harbor at San Juan, P. R.

DAILY LABOR REPORT.
NEW GALLITZIN TUNNEL,
PENNA. RAILROAD,
GALLITZIN, PA.

P. F. BRENDLINGER,
CONTRACTOR,
1009 Arcade Building,
PHILA., PA. DATE,..................190..

GENERAL FORCE.	$	Cts.
General Superintendent		
Tunnel Superintendent		
Ass't Tunnel Superintendent		
Chief Clerk,		
Office		
TOTAL		

EXCAVATION—DAY SHIFT.

WEST END.				EAST END.			
NO.	OCCUPATION.	RATE PER DAY.	AMOUNT.	NO.	OCCUPATION.	RATE PER DAY.	AMOUNT.
	HEADING.				HEADING.		
	Foremen				Foremen		
	Drill Runners				Drill Runners		
	Drill Helpers				Drill Helpers		
	Column Jackers				Column Jackers		
	Nippers				Nippers		
	Muck Foremen				Muck Foremen		
	Muckers				Muckers		
	Timber Foremen				Timber Foremen		
	Timbermen				Timber Men		
	Water Boy				Water Boy		
	Driver				Driver		
	Lampman				Lampman		
	BENCH				BENCH		
	Foremen				Foremen		
	Timber Men				Timber Men		
	Pitmen				Pitmen		
	Muckers				Muckers		
	Drivers				Drivers		
	Water Boy				Waterboy		
	Nipper				Nipper		
	Powdermen				Powdermen		
	Shovel Engineer				Shovel Engineer		
	Shovel Cranesman				Shovel Cranseman		
	Dinkey Runners				Dinkey Runners		
	Brakesmen				Brakesmen		
	Blacksmith				Blacksmith		
	Blacksmith Helper				Blacksmith Helper		
	Timekeepers				Timekeepers		
	Watchmen				Watchmen		
	Compressor Engineer				Compressor Engineer		
	Compressor Firemen				Compressor Firemen		
	Machinist				Mechanical Engineer		
	Stable Boss				Stable Boss		
	Drivers				Drivers		
	Hired Teams				Hired Teams		
	Carpenters				Carpenters		
	Carpenter's Helpers				Carpenter's Helpers		
	Dump Foremen				Dump Foremen		
	Dumpmen				Dumpmen		
	Crossing Watchmen				Crossing Watchmen		
	Drill Runners				Drill Runners		
	Drill Helpers				Drill Helpers		
	TOTAL				TOTAL		

MASONRY—DAY SHIFT.

WEST END.				EAST END.			
NO.	OCCUPATION.	RATE PER DAY.	AMOUNT.	NO.	OCCUPATION.	RATE PER DAY.	AMOUNT.
	RUBBLE SIDE WALLS.				RUBBLE SIDE WALLS.		
	Foremen				Foremen		
	Masons				Masons		
	Mason's Helpers				Mason's Helpers		
	Laborers				Laborers		
	Mortar Mixers				Mortar Mixers		
	Dinkey Runners				Dinkey Runners		
	Dinkey Brakemen				Dinkey Brakemen		
	TOTAL				TOTAL		
	CONCRETE.				CONCRETE.		
	Foremen				Foremen		
	Skilled Laborers				Skilled Laborers		
	Inside Laborers				Inside Laborers		
	Outside Laborers				Outside Laborers		
	Hoisting Engineers				Hoisting Engineers		
	Dinkey Runners				Dinkey Runners		
	Dinkey Brakemen				Dinkey Brakemen		
	TOTAL				TOTAL		
	PORTAL.				PORTAL.		
	Masonry Foremen				Masonry Foremen		
	Masons				Masons		
	Mason's Helpers				Mason's Helpers		
	Laborers				Laborers		
	Hoisting Engineers				Hoisting Engineers		
	Mortar Mixers				Mortar Mixers		
	TOTAL				TOTAL		
	DAY SHIFT.				DAY SHIFT.		
	Quarrying Stone				Quarrying Stone		
	Foremen				Foremen		
	Quarrymen				Quarrymen		
	Laborers				Laborers		
	Hired Teams				Hired Teams		
	TOTAL				TOTAL		

RECAPITULATION. GENERAL FORCE.		$	Cts.
West End Tunnel	Day		
	Night		
East End Tunnel	Day		
	Night		
RUBBLE SIDE WALL.			
West End	Day		
	Night		
East End	Day		
	Night		
Portal Masonry	West End		
	East End		
CONCRETE MASONRY.			
West End Tunnel	Day		
	Night		
East End Tunnel	Day		
	Night		
Quarrying Stone			
Floating Gangs			
	Total		
	Previous		
	Total to Date		

Signed .... Chief Clerk.

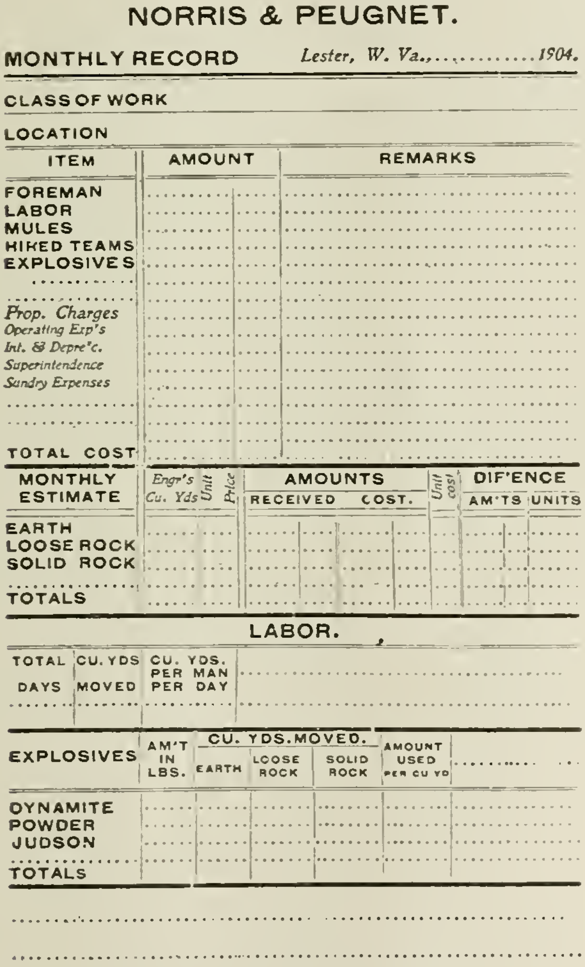
The "Swelling" of Rock Upon Excavation.

One of the editors of this paper, some years ago, built a section of a railroad in the south where many of the embankments were made from borrow pits, the material being solid rock. These pits were not cross-sectioned, and the specifications stated that when excavation was measured in embankment, that it should be considered that one yard of solid rock in place would make 1.75 cu. yds. in embankment. The editor protested against this, believing he was being deprived of from 15 to 20 per cent of his yardage, but as he could show no authentic records to disprove the engineer's claim, he was paid on the basis given in specification.

We are able to give an example when it was possible to obtain the exact yardage taken from the cut, and the amount it made in the fill. At Boulder, Colo., a cut of 3,600 cu. yds. made an embankment of 5,340 cu. yds., which is a ratio of 1 to 1.51.

In blasting rock for excavation on railroads, the mass comes out in pieces of all sizes, and as they are placed in the embankment voids of considerable size are made between the pieces. If the excavated rock has a layer of overlying earth on it that has not been stripped off before the rock is blasted, much of this earth, and the rock that is ground up fine, go to fill up these voids, making the embankment more compact than where there is no dirt excavated in connection with the rock. The result is that rock by itself "swells" more than it does when excavated in connection with earth and loose rock.

The writer's experience is that with solid rock first stripped and then excavated, the example given at Boulder is a fair average; but, with rock excavated where the solid rock is excavated in connection with loose rock and earth, this ratio of expansion is too high. For the last named excavation 1 to 1.4 is about the proper ratio.



NORRIS & PEUGNET.

MONTHLY RECORD Lester, W. Va., ... 1904.

CLASS OF WORK

LOCATION

ITEM	AMOUNT	REMARKS
FOREMAN		
LABOR		
MULES		
HIKED TEAMS		
EXPLOSIVES		
Prop. Charges		
Operating Exp's		
Int. & Depre'c.		
Superintendence		
Sundry Expenses		
TOTAL COST		

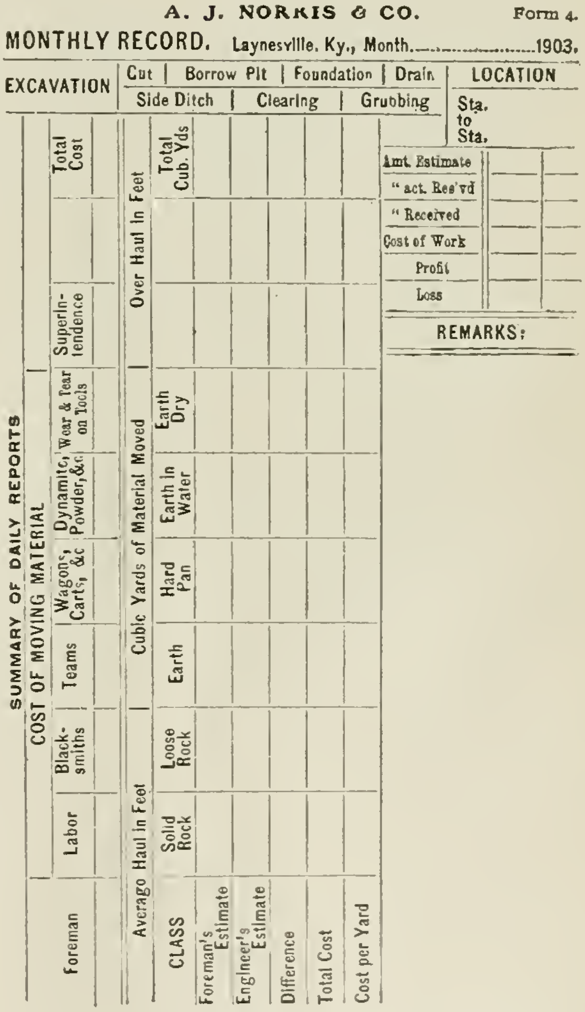
MONTHLY ESTIMATE	*Engr's Cu. Yds*	*Unit Price*	AMOUNTS RECEIVED	AMOUNTS COST.	*Unit cost*	DIF'ENCE AM'TS	DIF'ENCE UNITS
EARTH							
LOOSE ROCK							
SOLID ROCK							
TOTALS							

LABOR.

TOTAL DAYS	CU. YDS MOVED	CU. YDS. PER MAN PER DAY	

EXPLOSIVES	AM'T IN LBS.	CU. YDS. MOVED. EARTH	CU. YDS. MOVED. LOOSE ROCK	CU. YDS. MOVED. SOLID ROCK	AMOUNT USED PER CU YD	
DYNAMITE						
POWDER						
JUDSON						
TOTALS						

Fig. 3.—Cost Keeping on Railroad Construction—Form for Monthly Resume of Daily Reports.



A. J. NORRIS & CO. Form 4.

MONTHLY RECORD. Laynesville, Ky., Month.......................1903.

EXCAVATION Cut | Borrow Pit | Foundation | Drain
Side Ditch | Clearing | Grubbing

LOCATION
Sta. to Sta.

Amt. Estimate		
" act. Rec'vd		
" Received		
Cost of Work		
Profit		
Loss		

REMARKS:

SUMMARY OF DAILY REPORTS

COST OF MOVING MATERIAL

Foreman	Labor	Black-smiths	Teams	Wagons, Carts, &c	Dynamite, Powder, &c	Wear & Tear on Tools	Superintendence	Total Cost

Average Haul in Feet

Cubic Yards of Material Moved

Over Haul in Feet

CLASS	Solid Rock	Loose Rock	Earth	Hard Pan	Earth in Water	Earth Dry			Total Cub. Yds
Foreman's Estimate									
Engineer's Estimate									
Difference									
Total Cost									
Cost per Yard									

Fig. 4.—Cost Keeping on Railroad Construction—Form for Monthly Resume of Daily Reports.

No doubt many of our readers have some data on this subject, and some of those that have not, may be in a position to obtain some information of this kind that is reliable. We shall be glad to hear from such engineers as to their experience and receive accurate figures from them.

Four Examples of the Cost of Excavating Earth in the Wheeled Scraper.

In our issue of September 4 we gave the cost of a job of wheeled scraper work. In this article we give four examples of cost of doing similar work. They are all work done in grading railroads. The wages paid for a ten-hour day were:

Foreman	$ 3.00
Scraper team and driver	4.75
4-horse plow team and 2 men	9.20
3-horse snatch team and 1 man	6.00
Loaders	1.60
Dumpmen	1.50
Water boy	1.00

The teams were hired, and the fact that work was plentiful in that section of the country made the teamsters very independent, which helps to account for some of the high cost.

A four-horse plow team was used to loosen the dirt, and a three-horse snatch team was used in loading the scrapers. The wheelers were No. 2½, holding 1/3 cu. yd. place measurement. Two men were used to load the scrapers. This allows of quicker loading than where only one man is used. Two men also dumped the scraper, except in Example No. 1. There was no need for this, except that a man could not be made to dump the scrapers without help. This of course doubled the cost of dumping. All the work was done in the fall of the year, the weather being very good for grading work.

Example I. The material in this case was a sandy loam, easily plowed and scraped, so as to make a heaping scraper load. The lead was 260 ft., the distance traveled on each trip by a team being 600 feet. This made a total distance per day for scraper of about 12 miles. The cost in detail per cubic yard was as follows:

	Per cu. yd.
Foreman	$0.017
Scrapers	.138
Plowing	.052
Snatching	.034
Loaders	.018
Dumping	.008
Water boy	.006
Total	$0.273

The average yardage moved per day for a scraper was 34, while per team employed it was 21.

Example II. The material on this job was a good clay. Five scrapers were worked in a gang in this example as well as in Example I. The lead was 300 ft., while the average distance traveled to the dump and back was about 700 ft., which meant a total distance covered each day by a scraper team was about 12 miles. The cost in detail per cubic yard was as follows:

	Per cu. yd.
Foreman	$0.019
Scrapers	.158
Plowing	.057
Snatching	.037
Loaders	.020
Dumping	.016
Water boy	.004
	$0.311

The average yardage moved per scraper per day was 30 while per team employed it was 19.

Example III. The material in this cut was wet clay, made so by some heavy rains and springs that were struck in the ground. The lead was 400 feet, while the distance traveled on each trip was 1,000 ft., making a total distance traveled per scraper per day of 12½ miles. The dump was on marshy land which made necessary an extra laborer on the dump who shoveled dirt ahead of the teams. The cost per cubic yard in detail was as follows:

	Per cu. yd.
Foreman	$0.026
Scrapers	.216
Plowing	.080
Snatching	.052
Loaders	.028
Dumping	.039
Water boy	.009
	$0.450

The number of wheelers worked in a gang was five. The average yardage moved by each scraper was 22, while that per team was 13.

Example IV. This material was a fine sand, into which the wheels sank so the scraper bowls dragged on the ground. Six scrapers worked in a gang. The lead was 500 ft., the average distance traveled going to the dump and returning being a 1,000 ft., making the distance covered per day for scraper 12½ miles. The cost per cubic yard in detail was:

	Per cu. yd.
Foreman	$0.024
Scrapers	.222
Plowing	.073
Snatching	.050
Loaders	.026
Dumping	.027
Water boy	.008
	$0.430

The average yardage moved per scraper was 21½; per team it was 13.

The plow teams loosened in the four examples respectively 170, 150, 115 and 125 cu. yds. This did not keep them busy during the day, as they could have readily loosened twice the amount they did. The snatch team could also have loaded a greater yardage. This shows that there were not enough scrapers worked in a gang.

A matter of interest is the decreased yardage moved by a scraper as the haul is increased. It was as follows:

	Cu. yds.
260 ft. lead	34
300 ft. lead	30
400 ft. lead	22
500 ft. lead	21½

It will be noticed that in all cases a scraper team traveled between 12 and 12½ miles per day. It could have been possible to have covered a greater distance.

These examples can be readily compared with the one given in our issue of Sept. 4, as the same wages were paid. The lead in that case was 700 ft., and 23 cu. yds. were moved per scraper day. The following table allows of comparison of the five examples:

	Ex. 1. 200′ lead.	Ex II. 300′ lead.	Ex. III. 400′ lead.	Ex. IV. 500′ lead	Ex. V. 700′ lead.	Average 432′ lead.	Pct.
Foremen	$.017	$.019	$.026	$.024	$.020	$.021	6.0
Scrapers	.138	.158	.216	.222	.210	.189	51.6
Plowing	.052	.057	.080	.073	.053	.063	17.2
Snatching	.034	.037	.052	.050	.030	.040	10.9
Loaders	.018	.020	.028	.026	.020	.022	6.0
Dumping	.008	.016	.039	.027	.033	.025	6.8
Water boy	.006	.004	.009	.008	.001	.006	1.5
Total	$.273	$.311	$.450	$.430	$.367	$.366	100.0

It must be borne in mind that the dumping cost is abnormally high as previously explained. The foreman cost varied but slightly. One thing worthy of note is that the scraper cost is a little more than one-half the entire cost, and, inasmuch as the income from the work is gauged entirely by their work, it is evident that each scraper must make more than 100 per cent profit in order to secure a net profit on the job for the entire outfit. It will be noticed that nothing has been allowed here for office expense and superintendence, nor for repairs and renewals.

The "Dallett" Hose Coupling.

In our last issue we described briefly a hose coupling designed to overcome a common defect in couplings—namely: leakage after being in use for a short time. We have received a number of inquiries regarding this coupling and in response to these and to correct the oversight by which the name of the manufacturer was omitted in the description we would state that the coupling described in our issue of last week is manufactured by the Thos. H. Dallett Co., Philadelphia, Pa.

The new Bute dock opened in July, at Cardiff, England, is 2,550 ft. long, 800 ft. wide, and 50 ft. from coping to level of dock bottom. The sea locks have a length of 850 ft. between the outer and inner gates and are 90 ft. wide.

The Maryland Steel Co. was awarded the contract at $758,600 for construction of steel and masonry approacnes to Blackwell's Island Bridge, New York City.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Cost of a Macadam Road in Maryland.

The work to be described consisted of building a macadam road 5,400 ft. long by day labor, under the supervision of Mr. W. W. Crosby, Chief Engineer of the Highway Division of the Maryland Geological Survey. The road was located at Snow Hill, Worcester County, Maryland. It was graded to a width of 24 ft. and macadamized to a width varying from 12 to 18 ft.

The engineer's preliminary estimate of the cost of doing the work was as follows:

Excavation (sandy loam, average haul 1,000 ft.) 1.000 cu. yds. at 40c.	$ 400.
Masonry, concrete or rubble, 4 cu. yds at $6	24.00
Vitrified clay pipe, 18 ins., 26 lin. ft., at $1	26.00
Macadam (6 in. after rolling), 7.480 sq. yds., at 90c	6,732.00
Unforseen contingencies 10 per cent	718.20
Total	$7,900.20

The actual cost of the road was as follows:

2,524.26 tons No. 1 and 2 stone at 0.495	$1,250.92
354.50 No. 3 (screenings) at 0.30	106.82
2.878.76 tons freight at 1.263	3,637.36
Demurrage charges	186.00
Total cost of stone delivered	$5,181.10
Unloading 2,879 tons stone	$ 117.40
Hauling 2,879 tons stone	558.30
Spreading 2,879 tons stone	100.10
Rolling 2.879 tons stone	688.82
Sprinkling 2,879 tons stone	22.15
Total cost of stone in place	$6.657.87
1,771 cu. yds. excavation at 39.6c	$ 701.32
Shaping roadbed	74.80
Masonry (labor and materials)	19.75
Superintendence	227.50
Grand total	$7,691.24

This is equivalent to about $7,500 a mile for a macadam road averaging 13¾ ft. macadamized.

The wages paid were very low, and were as follows per hour:

Laborer	10 cts.
Single team with driver	20 cts.
Double team with driver	40 cts.
Roller engineer	16 2-3 cts.
Foreman	32½ cts.

There is no stone in this part of Maryland, so it was brought from Pensylvania by rail, making the cost delivered nearly $2.30 per ton. Mr. Crosby informs us that the stone weighed 2,500 lbs., or 1¼ tons, per cu. yd., measured loose. Hence a cubic yard of the loose stone cost nearly $2.87 delivered on cars, which is a high price to pay for stone, and accounts in large measure for the high cost of the macadam.

The holes in the screen were 2½, 1¾ and ¾ ins. in diameter, the stone passing through the 2½-in. hole being No. 1, and through the ¾-in. being No. 3. It will be noted that the No. 3, or screenings, constituted a little more than 12% of the total. The stone was a rather soft dolomitic limestone.

The stone was shoveled from the cars at a cost of only 4.3 cts. per ton, or 5.4 cts. per cu. yd. It was hauled an average distance of 3,000 ft. at a cost of 19 cts. per ton. It was spread at a cost of only 3½ cts. per ton. Even with wages at 10 cts. per hour, these are very low costs. The rolling, however, was very expensive, costing 23.7 cts. per ton. The cost of rolling includes not only wages and coal but an allowance of $3 a day for the use of the roller. Mr. Crosby states that this high cost is due to the fact that the steam roller weighed only 7 tons, and was a two-wheeler, not well adapted for rolling macadam. The cost of rolling of course includes the cost of rolling the subgrade.

The sprinkling was an unusually low item of cost, due, Mr. Crosby writes, to the fact that there were frequent rains during the work.

Since there were 7,480 sq. yds. of macadam 6 ins. thick, and since it required 2,879 tons of stone, there were 0.385 tons used per sq. yd., or 0.31 cu. yds. of loose stone per sq. yd. If the macadam was 6 ins. thick (after rolling), it must have required $6 \times 0.31 = 1.86$ cu. yds. of loose stone and screenings to make 1 cu. yd. of macadam rolled in place. The usual amount is seldom in excess of 1.6 cu. yds. of loose stone and screens per cu. yd. of macadam (see Gillette's "Handbook of Cost Data," page 139), from which it appears evident that the actual thickness of this Maryland road is more than 6 ins. after rolling, or that some of the stone was forced into the subgrade during rolling.

Considering the low wages and the fact that the average haul of the excavated material was only about 1,000 ft., the cost of the excavation was high, being 39.6 cts. per cu. yd., exclusive of the cost of shaping the subgrade. The cost of this shaping was $74.80, which is equivalent to about 1.3 cts. per sq. yd. of macadam. But since the graded roadway was 24 ft. wide, the cost of shaping was about ½ ct. per sq. yd. of graded roadway. If we divide this $74.80 by the 1.771 cu. yds. of grading we get 4.2 cts. per cu. yd., which should be added to the 39.6 cts., if the total cost of grading and shaping the subgrade is desired. Considering the low wages paid, this was a high cost for shaping. (See Gillette's "Cost Data," page 80.) The grading was done with plows, picks, hand shovels and dump carts.

The cost per square yard of macadam in place may be summarized as follows:

	Per Sq. Yd. of Macadam.
0.385 tons stone, f. o. b., at 47 cts.	$0.181
" " " freight at $1.26	0.485
" " " demurrage	0.025
" " " unloaded at 4.3 cts.	0.016
" " " hauled at 19.0 cts.	0.074
" " " spread at 3.5 cts.	0.013
" " " sprinkled	0.003
" " " rolled at 23.7 cts.	0.092
Total	0.889
Excavation	0.093
Shaping roadbed	0.013
Superintendence	0.030
Grand total	$1.025

If we multiply by 6 the total of $0.889 per square yard we have $5.334, which is the cost per cubic yard of macadam measured rolled in place.

If we multiply the cost per ton of stone by 1¼ we have the cost per cubic yard of stone measured loose.

Shipping Contractors Horses in Cars.

We understand that in the northwest the railroads receive from 14 to 16 horses to be shipped in a stock car, charging the minimum shipping weight, 28,000 lbs., or an average per horse of 2,000 lbs. A 30,000-lbs. capacity car, 30 ft. long, would accommodate this number of horses giving them each about 2 ft. of space.

In the south the writer has been accustomed to ship 20 mules in a car paying for the actual weight of the mules. The length of the car would vary from 30 to 33 ft., thus giving a little over 1½ ft. of space to a mule. In a 36-ft. car 21 or 22 mules could be shipped.

In a palace stock car ranging in length from 54 to 57 ft., the writer has shipped 30 mules, thus giving a space of about 1.8 ft. per mule. A few horses were generally shipped with the mules, but horses cannot be crowded as much as mules can, and at times a separate stall must be built for a valuable horse to keep the mules from crowding or injuring it.

In loading mules into a car a well broken horse is frequently a great help, as mules will follow horses as a rule, and by leading in the horse, several mules can be taken into the car right behind him.

When it is realized that animals, unless shipped in palace stock cars, must be unloaded on a long journey once every 24 hours, so as to be fed and watered, the help of a horse in taking the mules in and out of a car is of great assistance, and saves much time. Railroad companies allow at least one care-taker to accompany a shipment of horses or mules, and he is a busy man when the time arrives for feeding the stock.

We would be glad to receive information from our readers on this subject.

Methods and Costs; Some Old, Some New.

Expansion Pipe Joint.—Expansion joints for a 12 in, cast iron pipe exposed on a trestle at a river crossing were made as follows: The pipe around and near each joint was covered heavily with North Carolina tar. Heavy canvas was then wrapped around the tar covering, more tar applied, and finally a second layer of canvas was secured by winding wire around the whole.

Stopping Leaks in Dams.—On some of the European canals, the old methods of stopping leakage in moveable dams by means of canvas, weeds, etc., have been replaced by using ashes or fine gravel, dropped from a boat along the upstream side. The currents leaking through draw the particles into the crevices and make them water tight.

Blasting Off Piles.—The following method was used in cutting off piles under water: Rings large enough to slip over the pile were formed of telegraph wire, and to each ring was attached in three separate places, half sticks of 40 per cent dynamite, with a percussion cap in each. These wire rings were let fall over the pile with sufficient electric fuse with waterproof insulation to reach the river bottom and were then connected to an electric battery. The piles were all cut off clean and sharp at the bottom.

Platform for Masons.—The stage described below was used by the masons in lining a mine shaft with brick to a depth of 590 ft. The shaft had a clear diameter of 12.3 ft. and the circular stage had a diameter of 11.97 ft., and was made with two hinged flaps at the side and an opening through which passed a 3¼ ft. pipe for ventilating the bottom workings. The stage was suspended from four pieces of rail, built into the upper part of the shaft by four 50 ft. lengths of chain, followed by differential pulley blocks with 50 ft. of chain, and a bottom length of 10 ft. of chain. The stage was shifted by four men, one to each tackle; it was held in position by four bolts shot into holes left in the brick work. The total weight of the stage was about one ton. The cost of the four differential blocks was about $210, while the saving, as compared with fixed staging, was said to be nearly $3.60 per foot of shaft.

Swamp Roads.—In Scotland the method sometimes adopted in the construction of wagon roads over bogs and marshes is to distribute the weight by means of a good layer of brush and by draining the surface. The drainage ditches should be so placed as not to impair the sustaining power of the natural crust of the bog. In the construction of these roads a layer of brush is placed over the bog, forming a mattress. On top of this brush is placed material taken from the side ditches and on top of this "blinding" is a 9 in. layer of larger stone, the whole being topped off with 5 in. of gravel or small broken stone. A temporary road across a marsh of soft mud covered with high grass was built recently in the following manner: Driftwood was placed along the line of the proposed road, the bottom layer of sticks being laid lengthwise and the top layer crosswise. High marsh grass was then cut and spread over the timber, and covered with earth, and the road was ready for use.

Removing Sticky Material From Dump Cars.—In excavating for a foundation at New York City part of the spoil was dumped into seagoing scows. The spoil was conveyed to the dock edge in 3-yard wooden side-dump cars and loaded by means of a stiff-leg derrick with 60 ft. boom seated in the edge of the dock. The pivots on the car trucks were removed and the car bodies used as boxes, seated flat on the car floors, from which they were lifted and reversed over the scows by four chains attached to their corners. The excavated material was sticky and tenacious and some difficulty was encountered in getting the cars to dump clean. This trouble was done away in the following manner: The original dumping arrangement of the cars consisted of one long side hinged by bars from each end pivoted in the centers of the end walls and operated by hand levers. These levers were removed and the lower edgs of the hinged sides provided with latches to lock them shut and with rings engaging the hooks of two of the hoisting chains. In dumping, the boxes are lifted from the cars and set on the deck of the scow, the chains slackened and the latches opened. When the hoist is again operated the chains first open up the revolving side and then lift the box, revolving it until the open side is down and all the contents are discharged.

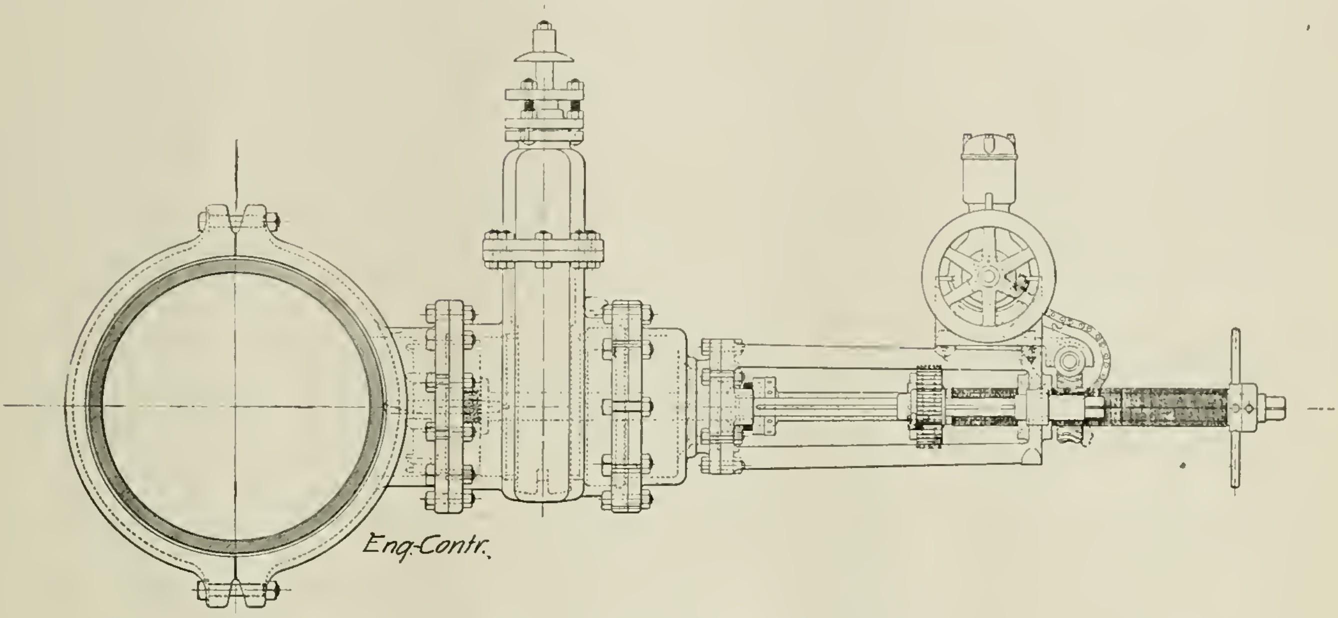
Carrying Conduits Over Waterway.—In constructing a conduit system for electric wires it became necessary to cross a small waterway under a bridge. As the bridge was old and liable to be replaced at any time, the duct line had to be placed so that the removal of the bridge would not interfere with it. Accordingly four 10 in. channels 50 ft. long were secured and made into a truss with side lattice bars. A manhole was built at one side of the bridge and a pier built at one end of the manhole as a part of it. The manhole foundation rested on 12 ins. of concrete reinforced with old rails. A concrete pier, 6x8 by 4 ft. thick was built on the other side of the bridge. The channels rested on these two piers entirely independent of the bridge structure. The ducts were then laid through the truss, and both enclosed in concrete, making practically a reinforced concrete beam.

Driving Sheet Piling.—Sheet piling made of 8x16 in. timber, 35 ft. long, with splined joints, was driven through 12 ft. of water to enclose the concrete walls of a 5x20 ft. conduit, 120 ft. long. The piling was driven by a 2,400-lb. hammer, in leads, carried on a 20x20 ft. rolling platform, the platform track parallel to the conduit being spiked to transverse ties projecting far enough beyond the outer rail to bolt to the upper outside waling piece. The inner waling piece was blocked out from it and rigidly braced. In this way the driver was centered on the line of piling and could be moved forward without adjustment. In connection with the work it was necessary to construct a cofferdam for the intake, so when the conduit had been completed the pile drivers were dismantled and the leads mounted on pairs of transverse cantilever beams overhanging opposite sides of a scow. The scow was towed to position and double lines of 12x12 in. sheet piling, with a maximum length of 50 ft., driven from the cofferdam. Sufficient overhang was given the leads, so that the piles could be driven in advance, thus forming a track on which they could be supported and moved forward beyond the initial position of the scow. The sides of the cofferdam were 60 ft. long, and after they had been completed the pile drivers were set transversely on the scow, so as to drive the end piles. In order to hold the piles while driving they were connected to the leads with bolts engaging sliding plates. To overcome the cramping of the piles under the blows, a special bolt, having a right-angled piece of iron welded to it was used to form a vertical seat on the rear face of the pile. The horizontal position of the bolt was extended through the leads and a nut on it engaged a vertical bearing plate sliding on the leads with moderate clearance. Three bolts in each pile held it accurately in position, and were successfully removed from the rear as the pile was driven.

According to a statement of expenditure just published, the Panama Canal has cost the American Government $34.449.000 up to Dec. 31, 1906. The bulk of this expenditure was the $50,000,000 to the French company and the Panama Government for canal property, right of way and franchises. Other expenditures were: Material and supplies, $3.449.022; general administration, $1.124.226: government and sanitation, $4.-381,089; construction and engineering, $9.-729.554. Other expenses include $12,138,-852 under the head of plant, which includes rolling stocks, machinery, second main track on Isthmus, buildings and zone water works.

A Machine, Run by a 5 H. P. Motor or Gasoline Engine, for Tapping Water Mains Under Pressure.

We illustrate herewith a novel and effective device for tapping a water main, under pressure, by means of power driven machine, instead of by hand. The illustration shows the tapping machine with a 5 H.P. gasoline engine attached, but it is also used with an electric motor. The machine will tap any main from 10 to 48 ins. in diameter, for a connection with a 10 to 24-in. pipe. By means of a crown saw, the machine cuts out the circular piece from the water main, working within a water-tight chamber, and then removes the disc through a gate valve. The illustration shows how the machine is fastened to the pipe by means of a split sleeve, the halves of which are bolted together. This sleeve has a special flanged joint, and is arranged so that cement is used instead of lead for filling the space between the sleeve and the main pipe. A quarter-inch lead gasket is placed between the joint faces of the sleeve.



Machine for Tapping Water Mains Under Pressure.

With this ingenious device it becomes unnecessary to shut off the water to tap a main, and, since it is operated by power, the work is cheaply and quickly done. It is made by the Water Works Equipment Co., 180 Broadway, New York City, from whom further information may be obtained.

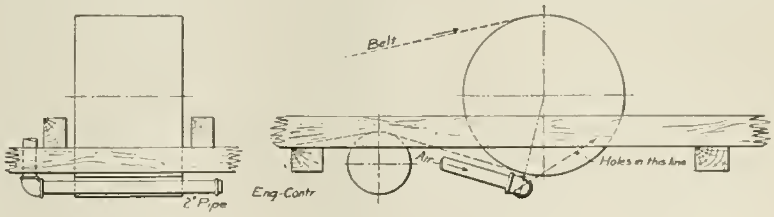
Construction work has already been started for the International Japanese Exhibition which is to be held in Tokyo next year. The total cost of the exhibition has been estimated at $10,000,000; one-half of this sum has been set aside by the government, while the remainder has been subscribed by private citizens. The exhibition is to open April 1 and will last until Oct. 15. Some of the principal exhibits will be of a scientific character.

A Device for Cleaning Conveyor Belts

Compressed air for removing wet and sticky materials from belt conveyers has been found effective when the usual method depending upon the use of brushes has failed. The device illustrated in the sketches here shown has for some time been in use at the Cananea Consolidated Copper Company's works at Cananea, Sonora, Mexico, and at the Old Dominion Copper Mining and Smelting Company's plant at Globe, Arizona. As far as known, all credit for the method and its application is due Charles F. Shelby, superintendent of the reduction division of the Cananea Consolidated Copper Company.

The device depends upon the impact of compressed air; the method of application is clearly shown in the sketches. Air under a pressure of 90 pounds is brought to the belt at a point immediately below the return pulley. The pipe is provided with 1/16-in. holes spaced by ½-in. centers, on the side opposite the belt and extending the entire width. The force of the air escaping through the 1/16-in. holes effectually clears the surface of the conveyor.—Engineering and Mining Journal.

The consumption of air would be great if the use of this device was continuous, but inasmuch as it is only used a few minutes at a time and at intervals, this is a matter of minor importance.



Device for Cleaning Conveyor Belts.

BOOK REVIEWS.

A New Paving Specification.

SPECIFICATIONS FOR STREET ROADWAY PAVEMENTS—By S. Whinery, M. Am. Soc. C. E.: New York, The Engineering News Publishing Co.; Paper 6x9 ins.; pp. 56; 50 cts.

This pamphlet contains a set of standard specifications covering all the commonly used pavements and their foundations. Not only are the specifications well prepared and carefully worded, but they contain foot notes explaining the reasons for adopting certain clauses and suggestions as to modifications that may be desirable under special conditions. The first part of the pamphlet contains general clauses governing contract work, and is then followed by a section on concrete foundations. The following are the different kinds of pavements for which specifications are given: Asphalt, rock asphalt, block asphalt, granite block, brick, wood block, and brief specifications for experimental or untried pavements. Nothing is said about macadam, nor about any of the patented pavements.

Engineers will be inclined to criticise certain sections of these specifications, but this is only natural, since there is such a wide diversity of opinion on subjects of this kind. We note, for example, that the author prohibits the plowing of the subgrade where the depth of the earth to be removed is less than 6 ins.. and he specifies that in no case must the plowing be allowed to penetrate within 1 in. of the subgrade. While this provision may be justified where the sub-grade is not to be rolled with a grooved roller, or with a petrolithic rolling tamper, it is certainly not justified where rolling with these tools is to be done. In the use of the petrolithic tamper, for example, the practice is to plow 6 ins. below the sub-grade, and then to tamp these 6 ins. thoroughly, the projecting prongs of the tamper penetrating through the plowed soil and compacting the earth from the bottom up. It would seem that this method of preparing sub-grades is far preferable to any other, particularly in view of the fact that natural soil is never as compact as it can be made under such tamping.

We note that the author recommends the laying of asphalt blocks on edge wherever the traffic is heavy. This seems to us a wholly unnecessary provision, since asphalt block on edge gives a depth of 6 ins. When asphalt blocks have worn down an average of more than 1 in., they will be found to have worn into pot holes, requiring the entire renewal of the blocks. Hence the life of the pavement is not measured by its total thickness. Asphalt blocks laid flatwise are becoming very popular on many residential streets in New York City, and we see no good reason why they should be specified to be laid on edge.

An examination of the clauses relating to block asphalt pavements fails to disclose a definite requirement as to whether the blocks are to be laid on edge or flatwise, although the method of laying is discussed in a foot note.

Taking the specifications as a whole, it would be hard to find a more satisfactory set of standard specifications for paving work.

Various improvements are projected to the North Sea Ship Canal at Amsterdam, in Holland, necessitated by the development of the trade and shipping of that Netherlands port. The improvements include the building of a second and larger lock at Ymuiden, the lighting by electricity of the North Sea Canal for night traffic, the deepening and widening of the canal, and the lighting of the interior of the harbor in the direction of the Orange locks.

A report to the Canadian Government on the progress of construction on the Grand Trunk Pacific Ry. up to the end of August shows that the steel had been laid for 124 miles westward from Portage la Prairie, of which 87 miles is ballasted, one-fifth of the grading between Winnipeg and Portage la Prairie is completed, while from the latter point to Saskatoon 85 per cent is finished. The company has 1,100 men and 800 teams at work on the 462 miles between Winnipeg and Saskatoon.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0356. **Expanded Metal.**—Expanded Metal Engineering Co., 255, 5th Ave. New York, N. Y.

The extended use of expanded metal for reinforcing concrete and the favor with which it has been received by engineers are well illustrated by the character and scope of the contents of this pamphlet. The pamphlet gives, first, a description of expanded metal and its characteristics as a system of reinforcement. This is followed by a large number of drawings showing typical forms of floor and slab construction of concrete and expanded metal, expanded metal lath, partition construction, column fireproofing, etc., are all considered. One of the most interesting portions of the pamphlet consists of a large number of half tones and line drawings showing structures in which expanded metal has been used as a reinforcement. The pamphlet closes with a theoretical discussion of reinforced concrete beams and slabs.

No. 0357. **Turbine Pumps.**—Tacony Iron Company, Philadelphia, Pa.

This pamphlet is really a set of directions for the installation of turbine pumps. The several styles of pumps are described and then tables, diagrams and illustrations are given to show how each should be installed to secure the best results. There is also an interesting argument intended to show the superiority of turbine pumps over reciprocating pumps.

No. 0358. **Turbine Pumps.**—The Watson-Stillman Company, New York, N. Y.

This pamphlet describes and illustrates in detail the constructions of the above named company's "Twinvolute" Turbine Pump. The illustrations are line drawings and the different parts are lettered and described in the text. In addition to the descriptive matter the pamphlet contains a number of pages of tables giving economic ratings of pumps, capacity of pumps of different sizes and of theoretical horse power. The pamphlet is generally well gotten up and is well worth securing.

No. 0359. **Locomotives.**—American Locomotive Co., New York, N. Y.

This pamphlet is devoted to the Prairie type of locomotive, as built by the company named. As in previous pamphlets of this series the different locomotives are illustrated on one page and on the opposite page are given the rates, dimensions, etc., of the locomotive illustrated. In addition to the halftone illustrations are a number of line drawings showing typical sections and elevations of the Prairie type of locomotive. The pamphlet is excellently printed.

No. 0360. **Concrete Block Machine.**—Brandell Concrete Block Machine Company, Chicago, Ill.

The block machine described in this pamphlet is of the face down, horizontal core type. Halftones are given illustrating the machine in its various positions and the text describes the construction and operation of the machine in some detail. There are a number of illustrations of concrete blocks manufactured by this machine. Figures are given showing the cost of concrete block making, and there are a number of recipes for coloring concrete blocks.

No. 0361. **Grinding and Polishing Machinery.**—Builders' Iron Foundry, Providence, R. I.

This is the catalog and price list of the various styles of polishing and grinding machines handled by the firm named. Interspersed with the regular catalog matter there are a number of bright detail descriptions of special machines and special appliances for grinding and polishing machinery.

No. 0362. **Concrete Mixer.**—Chicago Concrete Mixer Co., 20 South Canal St., Chicago, Ill.

The concrete mixer described and illustrated in this pamphlet is a cylindrical drum machine with inside mixing blades. The machine discharges without tilting, and will discharge either the whole or a part of its batch at a time. The pamphlet gives a fairly good description of the construction of the machine and tables of weights, capacities, etc.

No. 0363. **Well Drilling Tools.**—American Well Works, Aurora, Ill.

This pamphlet describes and illustrates the full line of well building tools manufactured by the company above named. The tools comprise complete outfits for well drilling, including engines, boilers, etc., as well as lists of the various small tools used in well drilling work. Sizes and dimensions are given of all the tools mentioned.

No. 0364. **Toxement.**—Toch Bros., 320 Fifth Ave., New York, N. Y.

This little pamphlet gives the result of a number of experiments made to show the water-proofing value of Toxement. This material is intended to be mixed with the dry cement before the sand and aggregate are added and is claimed to be absolutely harmless in its effect upon the mixed concrete.

Personals.

Mr. Robert Gray has been elected City Engineer of Bristol, Va.

Mr. C. E. Grafton has opened an office at New Cumberland, W. Va., for consulting practice in civil and mining engineering.

Mr. H. P. Boardman has resigned his position as engineer of branch canals for the Sanitary District of Chicago, and has accepted a position as Professor of Civil Engineering in the University of Nevada.

Mr. E. E. Fitzpatrick, formerly General Foreman for Doyle & Schwartz on sewer construction at Wichita, Kan, has accepted a position as Superintendent of Construction on the sewer being built at Winfield, Kan.

Mr. W. G. Bierd, formerly General Manager of the Panama Railroad, has accepted a position with the New York, New Haven & Hartford Railroad, under Mr. John F. Stevens, formerly Chief Engineer of the Panama Canal.

Mr. Furnam J. Stout, General Manager of the Lake Shore Electric Road, died September 15, at Toledo, O. He is said to have been the first to apply steam railroad methods to the management of an electric interurban railway.

Mr. S. A. Jordan has been appointed Division Engineer of the Philadelphia Division of the Baltimore & Ohio Railroad, succeeding Mr. A. A. Miller, resigned. Mr. E. V. Smith succeeds Mr. Jordan as Engineer of the Cleveland Division.

Mr. J. B. Myers has been appointed Division Engineer of the Cumberland Division of the Baltimore & Ohio Railroad, succeeding Mr. J. R. Leighty, resigned. Mr. P. H. Petrie succeeds Mr. Myers as Engineer of the Shenandoah Division.

Mr. A. M. Mullinix, of Fort Worth, Tex., Superintendent of Bridges and Buildings of the Fort Worth & Denver City Ry., died September 15, at Denver, Colo., where he had gone to recuperate from a recent attack of pneumonia. He was 49 years old.

Mr. Howard Egleston, for some time resident engineer on the Key West extension of the Florida East Coast Ry., has left that company and taken a similar position on the line now being constructed by Southern Pacific interests from Guaymas, Mexico, down the Pacific slope to the city of Guadalajara, Mexico.

Mr. M. L. Minter has resigned his position as Resident Engineer of the Galveston Terminal Co., and has accepted a position as Engineer of the Galveston Wharf Co., Galveston, Tex. He succeeds Mr. C. S. Corrigan, who has accepted a position with the Yankton & Southern Ry., in charge of surveys in Texas.

Rear Admiral John G. Walker, U. S. N., resigned, died suddenly September 15, at York Beach, Me. Admiral Walker was chairman of the Isthmian Canal Commission, appointed in 1897 by President McKinley. He then favored the Nicaraguan route, but when the French company offered all its works on the Isthmus of Panama for $40,000,000, Admiral Walker reported in favor of the Panama route.

At the opening exercises of Lehigh University on September 18, the following changes in the faculty of that institution were announced: Mr. P. B. de Schweinitz to be professor of machine design in the department of mechanical engineering. Mr. R. H. Heck, promoted from assistant professor of mechanical engineering, to professor of experimental engineering. Mr. F. P. McKibben to be professor of Civil Engineering. Mr. W. B. Schober, assistant professor of chemistry, to be full professor in that department.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Sept. 25.	Memphis, Mo.	Sept. 18
Sept. 27.	Denver, Colo.	Sept. 11
Sept. 27.	Bluefield, W. Va.	Sept. 25
Sept. 27.	Cincinnati, O.	Sept. 25
Sept. 28.	Chicago, Ill.	Sept. 25
Sept. 30.	Oakland, Cal.	Sept. 11
Sept. 30.	Lancaster, Pa	Sept. 18
Sept. 30.	Santiago, Chile	July 17
Sept. 30.	South Bend, Ind.	Sept. 25
Sept. 30.	Monticello, Ind.	Sept. 25
Sept. 31.	Guthrie, Okla.	Sept. 4
Oct. 1.	Spring Valley; Ill.	Sept. 25
Oct. 2.	Ashtabula, O.	Sept. 25
Oct. 2.	Evansville, Ind.	Sept. 25
Oct. 3.	Fergus Falls, Minn.	Sept. 18
Oct. 3.	New York, N. Y.	Sept. 25
Oct. 3.	Williamsport, Ind.	Sept. 25
Oct. 5.	Indianapolis, Ind.	Sept. 25
Oct. 5.	Indianapolis, Ind.	Sept. 25
Oct. 7.	Salem, Ind.	Sept. 11
Oct. 7.	Warren, O.	Sept. 18
Oct. 7.	Vevay, Ind.	Sept. 18
Oct. 7.	Vicksburg, Miss.	Sept. 18
Oct. 7.	Rushville, Ind.	Sept. 25
Oct. 7.	Tipton, Ind.	Sept. 25
Oct. 7.	Hammond, Ind.	Sept. 25
Oct. 7.	Crown Point, Ind.	Sept. 25
Oct. 7.	Kentland, Ind.	Sept. 25
Oct. 8.	Harrisburg, Pa.	Sept. 18
Oct. 8.	Delphi, Ind.	Sept. 18
Oct. 8.	Vicksburg, Miss.	Sept. 18
Oct. 8.	Summit, Pa.	Sept. 25
Oct. 8.	Hamilton, O.	Sept. 25
Oct. 8.	Fargo, N. Dak.	Sept. 25
Oct. 10.	Houston, Tex.	Sept. 25
Oct. 14.	Bellefontaine, O.	Sept. 25
Oct. 14.	Los Angeles, Cal.	Sept. 11
Oct. 14.	Fredericton, N. B.	Sept. 18
Oct. 15.	Dunrea, Man.	Sept. 4
Oct. 15.	Erie, Kan.	Sept. 18
Oct. 17.	Fort Logan Roots, Ark.	Sept. 25
Oct. 19.	Canton, China	Sept. 4

Buildings

Sept. 25.	Manitowoc, Wis.	Sept. 18
Sept. 26.	Muscatine, Ia.	Sept. 11
Sept. 26.	Riverside, Cal.	Sept. 11
Sept. 26.	New York, N. Y.	Sept. 18
Sept. 27.	Hesperus, Cal.	Sept. 11
Sept. 27.	Louisville, Ky.	Sept. 18
Sept. 28.	Fort Ethan Allen, Vt.	Sept. 18
Sept. 28.	South Sharon, Pa.	Sept. 18
Sept. 30.	Selma, Ala.	Aug. 28
Sept. 30.	West Point, N. Y.	Sept. 11
Sept. 30.	West Haverstraw, N. Y.	Sept. 18
Sept. 30.	Vincennes, Ind.	Sept. 18
Sept. 30.	New York, N. Y.	Sept. 25
Sept. 30.	Philadelphia, Pa	Sept. 25
Sept. 30.	Brooklyn, N. Y.	Sept. 25
Sept. 30.	New York, N. Y.	Sept. 25
Sept. 30.	Clearfield, Pa.	Sept. 25
Oct. 1.	Eau Claire, Wis.	Aug. 28
Oct. 1.	Pensacola, Fla.	Aug. 21
Oct. 1.	Indianapolis, Ind.	Sept. 4
Oct. 1.	Indianapolis, Ind.	Sept. 4
Oct. 1.	Albion, N. Y.	Sept. 25
Oct. 1.	Newark, N. J.	Sept. 25
Oct. 3.	Bayonne, N. J.	Sept. 11
Oct. 3.	Salem, Mass.	Sept. 25
Oct. 5.	New Orleans, La.	Sept. 11
Oct. 5.	Mount Healthy, O.	Sept. 18
Oct. 5.	Nat. Soldiers' Home, Cal.	Sept. 25
Oct. 7.	Baltimore, Md.	Aug. 28
Oct. 7.	Fort Slocum, N. Y.	Sept. 18
Oct. 7.	Fort Flagler, Wash.	Sept. 25
Oct. 7.	Philadelphia, Pa.	Sept. 25
Oct. 7.	Decatur, Ind.	Sept. 25
Oct. 7.	Fort Rosecrans, Cal.	Sept. 25
Oct. 8.	Paoli, Ind.	Sept. 25
Oct. 10.	Washington, D. C.	Sept. 25
Oct. 12.	Prescott, Ariz.	Sept. 18
Oct. 14.	San Diego, Cal.	Sept. 11
Oct. 15.	Las Animas, Colo.	Sept. 25
Oct. 15.	Los Angeles, Cal.	Sept. 25
Oct. 16.	Springfield, O.	Sept. 18
Oct. 16.	Harrisburg, Pa.	Sept. 25
Oct. 17.	Peoria, Ill.	Sept. 11
Oct. 17.	Fort McPherson, Ga.	Sept. 25
Oct. 18.	Montenallo, Ala.	Sept. 18
Oct. 18.	Denver, Colo.	Sept. 25
Oct. 21.	Des Moines, Ia.	Sept. 11
Oct. 21.	Milwaukee, Wis.	Sept. 18
Oct. 22.	Secaucus, N. J.	Sept. 25
Oct. 30.	Terre Haute, Ind.	Sept. 18
Oct. 30.	Atlanta, Ga.	Sept. 25
Nov. 5.	Bloomfield, Ind.	Sept. 18
Nov. 5.	Bloomfield, Ind.	Sept. 25
Nov. 9.	Las Animas, Colo.	Sept. 25

Roads and Streets.

Sept. 25.	University Heights, Ind.	Sept. 18
Sept. 25.	Richmond, Ind.	Sept. 18
Sept. 25.	Harrisburg, Pa.	Sept. 18
Sept. 26.	Danville, Ill.	Sept. 11
Sept. 26.	Fort Wayne, Ind.	Sept. 18
Sept. 26.	Bluffton, Ind.	Sept. 18
Sept. 26.	Kansas City, Mo.	Sept. 18
Sept. 26.	St. Paul, Minn.	Sept. 18
Sept. 26.	New York, N. Y.	Sept. 18
Sept. 27.	Milwaukee, Wis.	Sept. 25
Sept. 27.	New York, N. Y.	Sept. 25
Sept. 27.	Toledo, O.	Sept. 25
Sept. 27.	Mount Healthy, O.	Sept. 25
Sept. 28.	Manassas, Va.	Sept. 11
Sept. 28.	Vincennes, Ind.	Sept. 11
Sept. 28.	Greencastle, Ind.	Sept. 18
Sept. 28.	Fort Adams, R. I.	Sept. 25
Sept. 30.	New York, N. Y.	Sept. 18
Sept. 30.	Indianapolis, Ind.	Sept. 25
Sept. 30.	Milwaukee, Wis.	Sept. 25
Sept. 30.	Kansas City, Mo.	Sept. 25
Sept. 30.	St. Paul, Minn.	Sept. 25
Sept. 30.	Boston, Mass.	Sept. 25
Sept. 30.	Boston, Mass.	Sept. 25
Sept. 30.	Syracuse, N. Y.	Sept. 25
Sept. 30.	Devil's Lake, N. Dak.	Sept. 25
Sept. 30.	Montpelier, Ind.	Sept. 25
Oct. 1.	Billings, Mont.	Sept. 11
Oct. 1.	Durham, N. C.	Sept. 18
Oct. 1.	Fort Sam Houston, Tex.	Sept. 18
Oct. 1.	Belleville, N. J.	Sept. 25
Oct. 1.	Fort Adams, R. I.	Sept. 25
Oct. 1.	Reserve, Pa.	Sept. 25
Oct. 1.	Boston, Mass.	Sept. 25
Oct. 2.	Brooklyn, N. Y.	Sept. 25
Oct. 2.	Millvale, Pa.	Sept. 25
Oct. 2.	Spencer, Ind.	Sept. 25
Oct. 2.	Chicago, Ill.	Sept. 25
Oct. 3.	Harrisburg, Pa.	Sept. 18
Oct. 3.	New York, N. Y.	Sept. 25
Oct. 3.	North Braddock, Pa.	Sept. 25
Oct. 5.	Cleveland, O.	Sept. 18
Oct. 7.	Salem, Ind.	Sept. 11
Oct. 7.	Hartford City, Ind.	Sept. 18
Oct. 7.	Kenosha, Wis.	Sept. 18
Oct. 7.	Columbus, Ind.	Sept. 25
Oct. 7.	Sullivan, Ind.	Sept. 25
Oct. 7.	Decatur, Ind.	Sept. 25
Oct. 7.	Brookside, Ind.	Sept. 25
Oct. 8.	Vincennes, Ind.	Sept. 11
Oct. 8.	Covington, Ind.	Sept. 18
Oct. 8.	Monticello, Ind.	Sept. 25
Oct. 8.	St. Louis, Mo.	Sept. 25
Oct. 8.	Crawfordsville, Ind.	Sept. 25
Oct. 8.	Palatka, Fla.	Sept. 25
Oct. 8.	Portland, Ind.	Sept. 25
Oct. 8.	Logansport, Ind.	Sept. 25
Oct. 9.	Harrisburg, Pa.	Sept. 18
Oct. 9.	Bluffton, Ind.	Sept. 25
Oct. 10.	Harrisburg, Pa.	Sept. 18
Oct. 10.	Harrisburg, Pa.	Sept. 25
Oct. 11.	Enid, Okla.	Sept. 25
Oct. 11.	Cincinnati, O.	Sept. 25
Oct. 12.	Fort Wayne, Ind.	Sept. 25
Oct. 14.	Sunman, Ind.	Sept. 11
Oct. 15.	Oscala, Fla.	Sept. 25
Oct. 21.	Logansport, Ind.	Sept. 25

Sewers.

Sept. 25.	Brooklyn, N. Y.	Sept. 18
Sept. 25.	Richmond, Ind.	Sept. 18
Sept. 25.	Chicago Heights, Ill.	Sept. 25
Sept. 26.	New York, N. Y.	Sept. 18
Sept. 27.	Delaware, O.	Sept. 11
Sept. 27.	North Chicago, Ill.	Sept. 11
Sept. 30.	New York, N. Y.	Sept. 18
Sept. 30.	Washington, D. C.	Sept. 18
Sept. 30.	Seymour, Ind.	Sept. 18
Sept. 30.	Drayton, N. Dak.	Sept. 18
Sept. 30.	Steubenville, O.	Sept. 18
Sept. 30.	Toledo, O.	Sept. 25
Sept. 30.	St. Paul, Minn.	Sept. 25
Sept. 30.	Cedar Rapids, Ia.	Sept. 25
Sept. 30.	Grand Forks, N. Dak.	Sept. 25
Oct. 1.	Cadillac, Mich.	Sept. 11
Oct. 1.	Paducah, Ky.	Sept. 11
Oct. 1.	Des Moines, Ia.	Sept. 18
Oct. 1.	New York, N. Y.	Sept. 25
Oct. 1.	Milwaukee, Wis.	Sept. 25
Oct. 1.	Sewickley, Pa.	Sept. 25
Oct. 1.	West New York, N. J.	Sept. 25
Oct. 1.	Troy, N. Y.	Sept. 25
Oct. 1.	Newark, N. J.	Sept. 25
Oct. 1.	Paducah, Ky.	Sept. 25
Oct. 1.	Jasper, Ala.	Sept. 25
Oct. 2.	Salem, Mass.	Sept. 18
Oct. 2.	Milwaukee, Wis.	Sept. 25
Oct. 2.	Millvale, Pa.	Sept. 25
Oct. 2.	Mingo Junction, O.	Sept. 25
Oct. 2.	Fort Bayard, N. Mex.	Sept. 25
Oct. 2.	Fort Crook, Neb.	Sept. 25
Oct. 3.	Fort Dade, Fla.	Sept. 11
Oct. 3.	St. Paul, Minn.	Sept. 25
Oct. 3.	Berwyn, Ill.	Sept. 25
Oct. 5.	Bisbee, Ariz.	Sept. 18
Oct. 7.	Linton, Ind.	Sept. 25
Oct. 7.	Rome, N. Y.	Sept. 25
Oct. 7.	Vicksburg, Miss.	Sept. 25
Oct. 14.	Carthage, Mo.	Sept. 25
Oct. 23.	Whiterocks, Utah	Sept. 25

Water Supply.

Sept. 25.	Rome, N. Y.	Sept. 11
Sept. 25.	Highlands, N. J.	Sept. 11
Sept. 25.	Summit, Ill.	Sept. 11
Sept. 25.	Fort Morgan, Ala.	Sept. 11
Sept. 25.	Chicago, Ill.	Sept. 18
Sept. 25.	Elkins, W. Va.	Sept. 18
Sept. 25.	Provincetown, Mass.	Sept. 25
Sept. 26.	Fort Barrancas, Fla.	Sept. 11
Sept. 27.	Washington, D. C.	Sept. 4
Sept. 27.	Hesperus, Colo.	Sept. 11
Sept. 27.	Madison, Wis.	Sept. 18
Sept. 28.	Manassas, Va.	Sept. 11
Sept. 28.	Fort Ethan Allen, Vt.	Sept. 18
Sept. 30.	Wilmington, Del.	Sept. 11
Sept. 30.	Fremont, Neb.	Sept. 18
Sept. 30.	Beaver City, Neb	Sept. 18
Sept. 30.	Duquoin, Ill.	Sept. 25
Sept. 30.	Oakland, Cal.	Sept. 25
Sept. 30.	Grand Forks, N. Dak.	Sept. 25
Sept. 30.	Cedar Rapids, Ia.	Sept. 25
Sept. 30.	Detroit, Minn.	Sept. 25
Oct. 4.	South Bend, Ind.	Sept. 25
Oct. 7.	Canon City, Colo.	Sept. 25
Oct. 9.	Fort Caswell, N. C.	Sept. 18
Oct. 9.	Fargo, N. Dak.	Sept. 25
Oct. 10.	Primghar, Ia.	Sept. 18
Oct. 10.	Fort Du Pont, Del.	Sept. 18
Oct. 23.	Atlanta, Ga.	Sept. 18

Miscellaneous.

Sept. 25.	Reading, Pa.,	Subway,	Sept. 11
Sept. 25.	Vancouver Barracks, Wash.,	Coal Sheds, Scale,	Sept. 11
Sept. 26.	Fort Dupont, Delaware City, Del.	Freight Wharf,	Sept. 4
Sept. 26.	Fort Dupont, Del.,	Wharf Work,	Sept. 11
Sept. 26.	New York, N. Y.,	Track Work,	Sept. 18
Sept. 26.	Newark, N. J.,	Garbage Disposal,	Sept. 18
Sept. 27.	Pittsburg, Pa.,	Monument,	Sept. 11
Sept. 27.	New York, N. Y.,	Pier Extension,	Sept. 18
Sept. 28.	San Francisco, Cal.,	Wharf,	Sept. 18
Sept. 30.	Washington, D. C.,	Search Light Outfit,	Aug. 7
Sept. 30.	Cincinnati, O.,	Dredge,	Sept. 11
Sept. 30.	Philadelphia, Pa.,	Dredge,	Sept. 11
Oct. 1.	Winnipeg, Man.,	Hydro-Electric Station,	Sept. 4
Oct. 1.	Fort Dade, Fla.,	Wire Fence,	Sept. 11
Oct. 2.	Wilkesbarre, Pa.,	Walls,	Sept. 25
Oct. 3.	Wilmington, Del.,	Stone Jetties,	Sept. 11
Oct. 3.	New York, N. Y.,	Stone Wall,	Sept. 30
Oct. 3.	Brooklyn, N. Y.,	Fence,	Sept. 30
Oct. 3.	Boston, Mass.,	Subway Enlargement,	Sept. 25
Oct. 5.	Franklin Shoals, Ark.,	Lock and Dam,	Aug. 7
Oct. 5.	Mobile, Ala.,	Locks and Dams,	Aug. 14
Oct. 5.	Mobile, Ala.,	Locks and Dams,	Sept. 11
Oct. 5.	Vicksburg, Miss.,	Lock and Dam,	Aug. 14
Oct. 7.	Toledo, O.,	Riprap Wall,	Sept. 18
Oct. 7.	New Orleans, La.,	Flagstaff,	Sept. 18
Oct. 9.	Asbury Park, N. J	Jetties,	Sept. 25
Oct. 14.	Cincinnati, O.,	Concrete Wall, Etc.,	Sept. 25
Oct. 21.	Louisville, Ky.,	Steel Barges,	Sept. 25
Oct. 25.	Charleston, S. C.,	Dredge,	Sept. 25
Oct. 31.	Mobile, Ala.,	Snagboat,	Sept. 11
Nov. 15.	Charleston, S. C.,	Street Lighting,	Sept. 11

Excavation, Earth and Rock.

Sept. 26.	San Francisco, Cal.,	Dredging,	Sept. 11
Sept. 27.	Cerro Gordo, Ill.,	Ditch Work,	Sept. 18
Sept. 30.	New York, N. Y.,	Dredging and Rock Removal,	Sept. 4

Sept. 30. Boston, Mass., Dredging, Sept. 11
Sept. 30. Charleston, Miss., Ditch Work, Sept. 18
Sept. 30. Marinette, Wis. Ditch Work, Sept. 25
Oct. 1. Onawa, Ia., Ditch, Sept. 18
Oct. 2. Falls, Pa., Dike, Sept. 25
Oct. 7. Detroit, Mich., Excavating, Sept 4
Oct. 8. Muscatine, Ia., Ditch Work, Sept. 18
Oct. 8. Detroit, Mich., Dredging, Sept 4
Oct. 9. Jacksonville, Fla., Dredging, Sept. 18
Oct. 10. Peterboro, Ont., Canal, Sept. 4
Oct. 10. Jacksonville, Fla., Rock Removal, Sept. 18
Oct. 10. Washington, D. C., Dredging, Jetty Work, Sept. 18
Oct. 10. Jersey City, N. J., Grading, Sept. 25
Oct. 12. Riverton, Ala., Excavation, Riprap, Sept. 18
Oct. 15. Estherville, Ia., Ditch Work, Sept. 25
Oct. 17. Albany, N. Y., Dredging, Sept. 25
Oct. 22. St. Paul, Minn., Dredging, Sept. 25
Oct. 25. Ivanhoe, Minn. Ditch Work, Sept. 25

Materials, Machines, Supplies, Tools Etc

Sept. 25. Washington, D. C., Machinery, Sept. 4
Sept. 26. New York, N. Y., Fence, Lumber, Etc., Sept. 18
Sept. 26. Newark, N. J., Fire Hose, Sept. 25
Sept. 27. Milwaukee, Wis., Special Castings, Sept. 25
Sept. 30. Cincinnati, O., Dredging, Sept. 4
Sept. 30. Los Angeles, Cal., Water Pipe and Pumping Machinery, Sept. 4
Sept. 30. West Point, N. Y., Gas and Electric Fixtures, Sept. 4
Sept. 30. New London, Conn., Generating Sets, Sept. 11
Sept. 30. Rochester, N. Y., Electric Plant, Sept. 11
Sept. 30. Portsmouth, Va., Paving Brick, Sept. 25
Sept. 30. New York, N. Y Hose, Play Pipes, Sept. 25
Oct. 1. Mare Island, Cal., Brick, Pump, Etc., Sept. 11
Oct. 1. New York, N. Y., Pipe, Machinery, Etc., Sept. 25
Oct. 1. Portsmouth, N. H Profiling Machine, Timber, Etc. Sept. 25
Oct. 1. Jefferson Barracks, Mo., Boilers, Sept. 25
Oct. 1. Indian Head, Md., Crane, Hoist, Sept. 25.
Oct. 1. Annapolis, Md., Tram Cars, Sept. 25
Oct. 1. Jeffersonville, Ind., Hose, Sept. 25
Oct. 1. Pensacola, Fla., Bunk Cells, Sept. 25
Oct. 2. Baltimore, Md., Pig Lead, Sept. 25
Oct. 4. Jacksonville, Fla., Generator, Etc., Sept. 11
Oct. 5. Washington, D. C., Launch, Hammers, Bolts, etc., Sept. 11
Oct. 5. Kewanee, Ill., Pumping Equipment, Sept. 18
Oct. 5. St. Louis, Mo., Steamboat, Sept. 25
Oct. 5. Union, W. Va., Pipe, Etc., Sept. 25
Oct. 7. Los Angeles, Cal., Cement Machinery, Sept. 25
Oct. 8. New York, N. Y., Broken Stone, Sept. 25
Oct. 14. Washington, D. C., Dynamite, Timber, Etc., Sept. 25
Oct. 15. Honolulu, T. H., Materials, Sept. 4
Oct. 15. Puget Sound, Wash., Timber, Bolts, Etc. Sept. 25
Oct. 15. Mare Island, Cal., Timber, Tools, Etc., Sept. 25
Oct. 21. Louisville, Ky., Dump Scows, Sept. 25

BIDS ASKED.

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Logan H. Roots, Ark.—Until Oct. 17, by the Quartermaster, for constructing 2-pipe concrete road culvert here.

Chicago, Ill.—Until 11 a. m., Sept. 28, by John J. Hanberg, Commissioner Pub. Wks., City Hall, for building sub and superstructure of South Ashland Ave. temporary bridge.

Springvalley, Ill.—Until 4 p. m., Oct. 1, by Anton Faletti, City Clerk, for building ice breaker and protection pier and driving pile booms on east side of Illinois River pier; also for completion of protection pier on west side.

Crown Point, Ind.—Until Oct. 7, by Chas. A. Johnson, County Auditor, for construction concrete arch on Cedar Lake Road.

Evansville, Ind.—Until Oct. 2, by Harry Stinson, County Auditor, for constructing three reinforced concrete bridges.

Hammond, Ind.—Until Oct. 7, by Chas. A. Johnson, County Auditor, Crown Point, Ind., for sub and superstructure and machinery for swing bridge over Calumet River at Columbia Ave., Hammond.

Indianapolis, Ind.—Until 10 a. m., Oct. 5, by County Commissioners for constructing 2 bridges and 5 culverts.

Kentland, Ind.—Until 1 p. m., Oct. 7, by County Commissioners, for construction of approaches to Stonchill bridge.

Monticello, Ind.—Until noon, Sept. 30, by County Commissioners, for constructing 7 bridge superstructures and stone abutments for 12 bridges.

Rushville, Ind.—Until 2 p. m., Oct. 7, by County Commissioners, for constructing 2 concrete bridges.

South Bend, Ind.—Until 11 a. m., Sept. 30, by County Commissioners for constructing 5 concrete culverts.

Tipton, Ind.—Until 1 p. m., Oct. 7, by County Commissioners, for bridge top, Turkey Creek ditch, near Windfall.

Williamsport, Ind.—Until 1 p. m., Oct. 3, by County Commissioners, for constructing steel and concrete bridge.

New York, N. Y.—Until 2 p. m., Oct. 3, by James W. Stevenson, Commissioner of Bridges, 13 Park Row, for constructing Madison Ave. bridge over Harlem River. Security required is $250,000.

Fargo, N. Dak.—Until noon, Oct. 8, by Arthur G. Lewis, County Auditor, for constructing two 20 foot bridges, a 40 foot bridge, a 90 foot bridge and a 100 foot bridge.

Ashtabula, O.—Until Oct. 2, by County Auditor, Jefferson, O., for constructing reinforced concrete bridge.

Cincinnati, O.—Until noon, Sept. 27, by Fred Dreihs, Clerk County Commissioners, for constructing, under Specifications No. 661, concrete box culvert in Millcreek Township.

Hamilton, O.—Until 10 a. m., Oct. 8, by Chr. Pabst, County Auditor, for constructing bridge over Two Mile Creek.

Bellefontaine, O.—Until 1 p. m., Oct. 14, by county commissioners, for constructing 67 ft. span steel bridge on concrete abutments.

Summit (P. O. Spartansburg), Pa.—Until 8 p. m., Oct. 8, by Road Commissioners, for small concrete bridge. .

Houston, Tex.—Until noon, Oct. 10, by County Auditor, for constructing bridge to cost about $20,000 over San Jacinto River on Houston and Crosby Road.

Bluefield, W. Va.—Until Sept. 27, by J. T. Akers, Clerk Supervisors, for constructing concrete bridge on Locust St.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Rosecrans, Cal.—Until noon, Oct. 7, by Lieut. B. H. L. Williams, Q. M., for frame boat house for submarine mine boats.

Los Angeles, Cal.—Until 2 p. m., Oct. 15, by C. G. Keyes, County Clerk, for kitchen building and extension to nurses' home at County Hospital.

National Soldiers' Home, Cal.—Until noon, Oct. 5, by T. J. Cochrane, Treasurer Pacific Branch, N. H. D. V. S., Soldiers' Home, for construction of combination dining hall and kitchen.

Las Animas, Colo.—Until 10 a. m., Oct. 15, by Bureau Supplies and Accounts, Washington, D. C., for constructing bakery and laundry buildings at Naval hospital, New Fort Lyons, Las Animas.

Las Animas, Colo.—Until 11 a. m., Nov. 9, Bureau Yards and Docks, Washington, D. C., for power plant, building and machinery at U. S. Naval Hospital, New Fort Lynn, Colo.

Denver, Colo.—Until 3 p. m., Oct. 18, by James Knox Taylor, Supervising Architect, Washington, D. C., for extension, etc., to U. S. Post Office at Denver.

Washington, D. C.—Until 2 p. m., Oct. 10, by Bernard R. Green, Superintendent of Construction of Buildings for National Museum, Library of Congress, for furnishing delivering, and erecting in place complete, the large metal, wood, and plate glass windows required for the new National Museum Building.

Atlanta, Ga.—Until 3 p. m., Oct. 30, by James Knox Taylor, Supervising Architect, Washington, D. C., for construction, including plumbing of superstructure of U. S. Post Office at Atlanta.

Fort McPherson, Ga.—Until 11 a. m., Oct. 17, by Lieut. W. E. Holliday, Q. M., for construction, plumbing and electric wiring of one brick stable for 76 animals and construction of frame wagon shed.

Clearfield, Ia.—Until Sept. 30, by W. M Long, Secy., for erection of high school building to cost $18,000. O. A. Hoagland, Arch., Chariton, Ia.

Bloomfield, Ind.—Until 2 p. m, Nov. 5, by County Commissioners, for new jail cell house.

Decatur, Ind.—Until 10 a. m., Oct. 7, by County Commissioners, for installing steam heat plant in county jail.

Paoli, Ind.—Until 2 p. m., Oct. 8, by County Commissioners, for repairs to court house.

Salem, Mass.—Until 7 p. m., Oct. 8, by the Mayor, for erection of new high school building. Kilham & Hopkins Archts., 9 Park st., Boston ,Mass. Bids are also asked for heating and ventilating and installing electric power plant in the school. Geo. Huey, Engineer, 7 Water St., Boston, Mass.

Newark, N. J.—Until 2 p. m., Oct. 1, by County Freeholders, for plumbing work at Essex County Prison, for alterations of fireproof stairs in old hospital for insane at Overbrook, and for installation of new boiler and hot water equipment at Essex County Prison buildings. Hurd & Sutton, Archs., 818 Union Bldg., Newark.

Secaucus, N. J.—Until 8 p. m., Oct. 22, by F. D. Boulanger, Borough Clerk, for erection of borough hall, lock-up and fire house. Chas. F. Long, Arch., 1 Montgomery St., Jersey City.

Albion, N. Y.—Until 1 p. m., Oct. 1, by Jane L. Armstrong, President Board of Managers, for construction, including heating, plumbing and electric work for one cottage for inmates at Western House of Refuge for Women, Albion. G. L. Heins, State Architect, Albany, N. Y.

Brooklyn, N. Y.—Until 2:30 p. m., Sept. 30, by Robert W. Hebberd, Commissioner of Charities, foot of E. 26th St., New York, for erection of Coney Island Hospital. Surety required is $120,000. Helmie & Hulberty, Archts., 190 Montague St., Brooklyn.

New York, N. Y.—Until 11 a. m., Sept. 30, by Joseph Bermel, President Queens Borough, Long Island City, for building public comfort station. Security required is $5,000.

New York, N. Y.—Until 11 a. m., Sept. 30, by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., for (1) installing heating and ventilating appartus, Public School 41; (2) installing electric equipment, Public School 59; and (3) installing heating and ventilating and electric generating apparatus and electric elevator in the Parental School, Flushing, Borough of Queens. Security required for (3) is $50,000.

Philadelphia, Pa.—Until 11 a. m., Oct. 7, by Lt. Col. F. G. Hodgson, Q. M., 26th St. and Gray's Ferry Road, for additions and alterations to certain buildings at Philadelphia depot of Q. M. Department.

Fort Flagler, Wash.—Until 11:30 a. m., Oct. 7, by Lieut. H. S. Miller, Q. M., for basement under Q. M. storehouse.

Philadelphia, Pa.—Until noon, Sept. 30, by Joseph S. Neff, Director Public Health, City Hall, for alterations and additions to toilet rooms, women's nervous and women's out wards and the construction of one-story brick toilet room on the side of each tower, Philadelphia General Hospital.

Harrisburg, Pa.—Until noon, Oct. 16, by H. L. Orth, State Lunatic Asylum, for erection of two buildings. J. Dempwolf., Archt., York, Pa.

Roads and Streets

Bids are asked on following work, the notes being arranged alphabetically by states:

Ocala, Fla.—Until Oct. 15, by H. C. Sistrunk, City Clerk, for 14,900 square yards vitrified brick paving.

Palatka, Fla.—Until Oct. 8, by E. S. Crill, Chairman Bond Trustees, for grading area of 22,800 square yards, furnish and lay 9,857 lin. feet granite curbing and 22,805 square yards vitrified brick or block pavement.

Chicago, Ill.—Until 10:15 a. m., Oct. 2, by Ora E. Chapin. Secy. Bd. Local Improvements, City Hall, for six contracts for street improvements.

Bluffton, Ind.—Until 10:30 a. m., Oct. 9, by C. D. Brineman, County Auditor, for 2 gravel roads in Lancaster and Jefferson Townships.

Indianapolis, Ind.—Until 10 a. m., Sept. 30, by Board of Public Works, for 4 contracts for grading and paving roadways and 1 contract for grading and paving sidewalks.

Brookside, Ind.—Until 1 p. m., Oct. 7, by Charles Miller, County Auditor, for constructing highway 2 miles and 3,573 feet long.

Columbus, Ind.—Until 7:30 p. m., Oct. 7, by Common Council, for grading, graveling and making cement walks and curbs.

Decatur, Ind.—Until 10 a. m., Oct. 7, by C. D. Lewton, County Auditor, for cement sidewalk.

Crawfordsville, Ind.—Until 1 p. m., Oct. 8, by B. F. Carmin, County Auditor, for 13.250 feet of broken stone road in Brown Township.

Fort Wayne, Ind.—Until 10 a. m., Oct. 12, by Geo. W. Lindemuth, County Auditor, for 6.000 ft. of macadam road in Monroe Township.

Logansport, Ind.—Until 10 a. m., Oct. 8, by Geo. W. Cann, County Auditor, for gravel road in Jackson Township.

Logansport, Ind.—Until 10 a. m., Oct. 21, by Geo. W. Cann, County Auditor, for gravel roads known as Rice Road.

Monticello, Ind.—Until noon, Oct. 8, by J. L. Ackerman, County Auditor, for gravel roads in Prairie, Monon and Jackson Townships.

Montpelier, Ind.—Until 8 p. m., Sept. 30, by Common Council, for cement walks on Windsor St.

Portland, Ind.—Until 10 a. m., Oct. 8, by County Commissioners for constructing 15 gravel roads.

Spencer, Ind.—Until noon, Oct. 2, by Geo. O. Mitten, County Auditor, for 1 1-6 mile of pike road in Jennings Township.

Sullivan, Ind.—Until noon, Oct. 7, by E. E. Russell, County Auditor, for 3 gravel roads, 30,680 feet long, in Haddon Township.

Boston, Mass.—Until noon, Oct. 1, by Boston Transit Commission, 15 Beacon St., for relaying about 2,000 sq. yds. of granite block paving on concrete base with pitch and pebble joints at various points over or near the Washington St. tunnel.

Boston, Mass.—Until noon, Sept. 30, by James H. Doyle, Superintendent of Streets, City Hall for constructing macadam roadways on Speedwell St., Dorchester, Kilton St., Dorchester, Bayswater St., East Boston, and Rockledge St., Roxbury.

Boston, Mass.—Until noon, Sept. 30, by William Jackson, City Engineer, City Hall, for paving and regulating Northern Ave. and Sleeper St., East Boston.

St. Paul, Minn.—Until 2 p. m., Sept. 30, by R. L. Gorman, Clerk Bd. Pub. Wks., for paving alley in Block 11.

Kansas City, Mo.—Until 3 p. m., Sept. 30, by Frank P. Gossard, Secy. Park Commissioners, for 4 contracts for constructing artificial stone curb and gutter.

St. Louis, Mo.—Until noon, Oct. 8, by W. B. Dryden, Secy. Board Public Improvements, for 36 contracts for street work.

Belleville, N. J.—Until 8:30 p. m., Oct. 1, by Thos. J. Breen, Chairman Township Committee, for constructing sidewalks. J. H. Francisco, Engineer, 751 Broad St., Newark, N. J.

Brooklyn, N. Y.—Until 11 a. m., Oct. 2, by Bird S. Coler, Borough President, for 16 contracts for street improvements.

New York, N. Y.—Until 11 a. m., Sept. 27, by Henry S. Thompson, Commissioner Public Works, for 45 contracts for street improvement work.

New York, N. Y.—Until 3 p. m., Oct. 3, by Park Board, Arsenal Bldg., Central Park, for regulating, grading, laying walk pavement of Portland cement and doing other work upon and adjacent to the site of the old engine house in City Hall Park. Security required is $1,400.

Syracuse, N. Y.—Until 1:30 p. m., Sept. 30, for 23 contracts for sidewalk construction.

Devils Lake, N. Dak.—Until noon, Sept. 30, by Ole Skratass, City Auditor, for constructing sidewalk.

Cincinnati, O.—Until noon, Oct. 11, by Fred Dreihs, Clerk County Commissioners for improvement, under Specifications No. 600, Hog Back road.

Enid, Okla.—Until noon, Oct. 11, by E. R. Lee, City Clerk, for grading, curbing, etc., and constructing 11,500 sq. yds. asphalt pavement. C. H. Sexton, City Engineer. Official advertisement will be found elsewhere in this issue.

Mount Healthy, O.—Until noon, Sept. 27, by Frank Williamson, Village Clerk, for constructing cement sidewalks on Second St. and Joseph St.

Toledo, O.—Until noon, Sept. 27, by Reynold Voit, Secy. Bd. Pub. Wks., for macadamizing Oregon Road.

Harrisburg, Pa.—Until Oct. 10, by State Highway Department, for constructing 11,100 ft. of road in Greenburn Borough, Lackawanna County.

Reserve, Pa.—Until noon Oct. 1, by Trumble & Miller, Engineers, Pittsburg, Pa., for building road in Reserve Township, Allegheny County.

Millvale, Pa.—Until Oct. 2, by Borough Council, for paving.

Fort Adams, R. I.—Until 10 a. m., Oct. 1, by Capt. W. C. Metcalf, Q. M., 209 Thames St., Newport, for repairs of roads, construction gutters, cement walks, etc.

Fort Adams, R. I.—Until 10 a. m., Sept. 28, by Capt. W. C. Metcalf, Q. M., 209 Thames St., Newport, R. I., for granolithic walk along post exchange building.

Milwaukee, Wis.—Until 10:30 a. m., Sept. 27, by Chas. J. Poetsch, Chairman Board Pub. Wks., for brick sidewalks in front of two fire engine houses.

Milwaukee, Wis.—Until 10:30 a. m., Sept. 30, by Charles J. Poetsch, Chairman Bd. Pub. Wks., for grading and macadamizing Chambers St.; also for macadamizing Mabbett Ave.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Jasper, Ala.—Until Oct. 1, by Mayor and Council, for installing $15,000 sanitary sewer system. P. Byrne, Engineer, Birmingham, Ala.

Berwyn, Ill.—Until 8 p. m., Oct. 3, by R. F. Stevens, Secy. Bd. Local Improvements, for constructing pipe sewer to cost about $4,909.

Chicago Heights, Ill.—Until 8 p. m., Sept. 25, by John Gravelot, Clk. Bd. Local Improvements, for construction of sewage disposal plant and sanitary sewer system. The official advertisement oppeared in our issue of Sept. 18.

Linton, Ind.—Until 4 p. m., Oct. 7, by Frank Spelberg, City Clerk, for sanitary sewer system, consisting of 13 miles of sewer and disposal plant. Estimated cost is $64,800.

Cedar Rapids, Ia.—Until 10 a. m., Sept. 30, by F. W. Barta, Chairman Public Improvement Committee, for constructing 7 foot brick storm sewer.

Paducah, Ky.—Until 3 p. m., Oct. 1, by L. A. Washington, City Engineer, for lateral connections in Sewer District No. 2.

St. Paul, Minn.—Until 2 p. m., Oct. 3, by R. L. Gorman, Clk. Bd. Pub. Wks., for sewer in Goff Ave.

St. Paul, Minn.—Until 2 p. m., Sept. 30, by R. L. Gorman, Clk. Bd. Pub. Wks., for constructing sewer in Franklin Ave.

Vicksburg, Miss.—Until 7:30 p. m., Oct. 7, by H. J. Trowbridge, City Clerk, for storm sewer in South Washington St.

Carthage, Mo.—Until 4 p. m., Oct. 14, by Wm. Kollman, City Engineer, for furnishing all materials and constructing complete 3,258 ft. of 8-in. and 410 ft. of 10-in. sewers, with manholes, flush tanks, etc.

Fort Crook, Neb.—Until 10 a. m., Oct. 2, by Maj. Thomas Cruse, Q. M., Omaha, Neb., for 10 inch sewer at Fort Crook.

Fort Bayard, N. Mex.—Until 11 a. m., Oct. 2, by Capt. S. P. Vestal, Q. M., for additional work in connection with sewage purification plant.

Newark, N. Y.—Until 10 a. m., Oct. 1, by Board of Managers, for sewage disposal plant for New York State Custodial Asylum, Newark. G. L. Heins, State Architect, Albany, N. Y.

Troy, N. Y.—Until Oct. 1, by Common Council, for sewer in alley between Locust and Maple Aves.

New York, N. Y.—Until 11 a. m., Oct. 1, by Louis F. Haffen, President Bronx Borough, 177th St. and Park Ave., for completing contract abandoned by Wm. J. Flanagan for constructing storm relief tunnel sewer from Webster Ave. sewer to Harlem River. Security required is $150,000.

West New York, N. J.—Until 8 p. m., Oct. 1, by James L. Wolfe, Town Clerk, for constructing sewer in Palisade Ave.; also for grading, flagging, curbing, paving of gutters and sewering of 13th St.

Rome, N. Y.—Until noon, Oct. 7, by James A. Douglas, President Board of Managers, for construction of sewage disposal plant at Rome State Custodial Asylum. G. L. Heins, State Architect, Albany, N. Y.

Mingo Junction, O.—Until noon, Oct. 2, by Frank McLister, Village Clerk, for constructing 2,400 ft. of 8-ft., and 1,800 ft. of 6-ft., brick or concrete sewer.

Toledo, O.—Until noon, Sept. 30, by Reynold Voit, Secretary Board Public Service, for constructing local sewer No. 1015.

Millvale, Pa.—Until Oct. 2, by Borough Council, for constructing sewer.

North Braddock, Pa.—Until 3 p. m., Oct. 3, by C. A. Stewart, Borough Engineer, for constructing 650 ft. 12-in., 480 ft. 8-in., 200 ft. 6-in. pipe sewers.

Sewickley, Pa.—Until 5 p. m., Oct. 1, by Frederick T. Martin, Boro. Engineer, 514 Broad St., for constructing 620 lin. ft., 8-in. vitrified pipe sewer.

Whiterocks, Utah.—Until 2 p. m., Oct. 23, by Commissioner of Indian Affairs Washington, D. C., for material and labor to construct sewer system and plumbing at Uintah and Ouray Agency, Utah. Information may be obtained from Capt. C. G. Hall, Acting Agent, Whiterocks.

Milwaukee, Wis.—Until 10:30 a. m., Oct. 2, by Charles J. Poetsch, Chairman Bd. Pub. Wks., for constructing pipe sewers in Greenfield Ave., Elizabeth Ave. and Dover Pl.

Milwaukee, Wis.—Until 10:30 a. m., Oct. 1, by Charles J. Poetsch, Chairman Bd. Pub. Wks., for constructing 4 pipe sewers and brick and pipe sewer.
BIDS ASKED

Water Supply

Bids are asked on following work, the notes being arranged alphabetically by states:

Oakland, Cal.—Until 10 a. m., Sept. 30, by John P. Cook, Clerk County Supervisors, for construction of water plant for county roads leading from Dublin to Pleasanton and from Dublin to Hayward.

Canon City, Colo.—The time for receiving proposals for building reservoir at Cottonwood Creek, and constructing pipe line has been extended to Oct. 7, at which date all bids must be in the hands of City Clerk, of whom specifications may be had.

Duquoin, Ill.—Until 8 p. m., Sept. 30, by Board Local Improvements, for furnishing and laying 1,620 ft., 10-in., 3,804 ft., 8-in., 18 130 ft., 6-in., and 33,500 ft., 4-in., cast iron water pipe, all 3½ ft. deep; also for setting 84 hydrants, 67 gate valves, 1,500 ft., 4-in. hydrant connections and 20,000 lbs. special castings.

South Bend, Ind.—Until Oct. 4, by Board Public Works, for making water connections in 3 streets.

Cedar Rapids, Ia.—Until 10 a. m., Sept. 30, by F. W. Barta, Chairman, Pub. Improvement Committee, for making connections with city water, sewer and gas mains.

Provincetown, Mass.—Until 1 p. m., Sept. 25, by Walter Welsh, Secy. Water Board, for laying 23,000 feet of 10 inch pipe and about 3,000 feet of 8 inch pipe in Provincetown and Truro.

Detroit, Minn.—Until Sept. 30, by W. L. Taylor, President, for erection of 50 foot steel tower and tank of 100,000 gallons' capacity and laying 600 to 1,000 feet of 8 inch water main.

Fargo, N. Dak.—Until Oct. 9, by A. G. Lewis, County Auditor, for constructing pneumatic pumping plant at County Hospital.

Grand Forks, N. Dak.—Until 4 p. m., Sept. 30, by W. V. O'Connor, City Auditor, for constructing water main.

Excavation—Earth and Rock

Bids are asked on following work, the notes being arranged alphabetically by states:

Estherville, Ia.—Ditch Work—Until Oct. 15, by R. J. Ridley, County Auditor, for constructing two tile ditches.

Ivanhoe, Minn.—Ditch Work—Until Oct. 25, by R. H. Sisson, County Auditor, for constructing Ditch No. 15.

St. Paul, Minn.—Dredging—Until Oct. 22, by George Ralph, State Drainage Engineer, for deepening and widening channel of Roseau River.

Jersey City, N. J.—Grading—Until 9 p. m., Oct. 10, by Board of Education for improvement of grounds around new high school building in Palisade and Newark Aves. John T. Rowland, Arch., 15 Exchange Pl.

Albany, N. Y.—Dredging—Until noon, Oct. 17, by F. C. Stevens, State Superintendent of Public Works, for contract No. 20, Erie Canal—Section 2, for dredging a channel in the Mohawk River and performing work incidental thereto between Rexford Flats and Crane's Village. Length of contract, 18.5 miles.

Falls, Pa.—Dike—Until noon, Oct. 2, by Thos. J. Lynch, Secy. State Water Supply Commission, Harrisburg, Pa., for repairs to dike along the bank of Delaware River in Falls Township.

Marinette, Wis.—Ditch Work—Until noon, Sept. 30, by Wm. C. Campbell, Secy. Drainage Commissioners, for constructing ditches and drains in 1st Drainage District, requiring about 130,000 cu. yds. excavation. .

Miscellaneous

Bids are asked on following work, the notes being arranged alphabetically by states:

Louisville, Ky.—Steel Barges—Until noon, Oct. 21, by Capt. H. Burgess, U. S. Engrs., for two steel barges.

Boston, Mass.—Subway Enlargement—Until noon, Oct. 3, by Boston Transit Commission, 15 Beacon St., for construction of part of new westerly wall, roof and invert for enlargement of subway, Haymarket Sq.

Asbury Park, N. J.—Jetties—Until Oct. 9, by W. P. Sherman, Secy. Public Grounds Commission, for plans and bids for building jetties to protect and build up the beach at Asbury Park.

Brooklyn, N. Y.—Fence—Until 3 p. m., Oct. 3, by Park Board, Arsenal Bldg., Central Park, New York, for erecting a three rail post and pipe wire mesh fence in McLaughlin Park, Borough of Brooklyn. Security required is $1,000.

New York, N. Y.—Stone Wall—Until 3 p. m., Oct. 3, by Park Board, Arsenal Bldg., Central Park, for constructing stone wall surmounted by an iron fence, in the Botanical Garden, in Bronx Park. Security required is $8,000.

Cincinnati, O.—Concrete Wall, Etc.—Until noon, Oct. 14, by Clerk Board of Education, City Hall, for construction of concrete retaining wall and parking of the lot of the Clifton School, corner Clifton Ave. and McAlpin Pl. E. H. Dornette, Arch., Room 54, Pickering Bldg.

Wilkesbarre, Pa.—Walls—Until 2 p. m., Oct. 2, by James M. Norris, County Controller, for building retaining and courtyard walls at new county court house.

Charleston, S. C.—Dredge—Until noon, Oct. 25, by Capt. E. R. Stuart, U. S. Engrs., for constructing hydraulic dredge.

Materials, Machines, Supplies, Tools, Etc

Bids are asked for the following, the notes being arranged alphabetically by states:

Los Angeles, Cal.—Cement Machinery—Until 11 a. m., Oct. 7, by H. B. Ferris, Secy. Bd. Pub. Wks., for the necessary machinery for the equipment of a Portland cement plant of a daily capacity of 1,000 barrels of manufactured cement.

Mare Island, Cal.—Timber, Tools, Etc.—Until 10 a. m., Oct. 15, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard a quantity of naval supplies as follows: Schedule 329—Galvanized sheet steel. Schedule 330—Power press. Schedule 331—Scales. Schedule 332—Gauge glasses. Schedule 333—Hardware and tools, pine redwood, oak, etc., galvanized corrugated iron, mild and tool steel.

Washington, D. C.—Dynamite, Timber, Etc. Until 10:30 a. m., Oct. 14, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Canal Circular 392—Automatic fire alarm telegraph systems, marine electric fixtures, fire hose, hose nozzles, fire harness and attachments, firemen's helmets, batteries, dynamite and blasting material, fusible plugs, wire, hoisting engines, shop machines, steel, iron, zinc, copper, brass, rivets, bolts, chain, wrought iron pipe, cast washers, gaskets, packing, rubber and wire sleeves for dredges, canvas, cotton waste, kerosene, oils, wrenches, ratchet drills, anvils, swage blocks, blacksmiths' mandrel, tire measuring wheels, crucibles, lamps, dump wagons, piles, bridge timber, etc.

Pensacola, Fla.—Bunk Cells—Until 10 a. m., Oct. 1, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard under Schedule 289, bunk cells.

Jeffersonville, Ind.—Hose—Until 10 a. m., Oct. 1, by J. M. Marshall, A. Q. M. G., for 5,000 ft. ¾-in. rubber hose.

Louisville, Ky.—Dump Scows—Until noon, Oct. 21, by Capt. H. Burgess, U. S. Engr., for two dump scows.

Annapolis, Md.—Tram Cars—Until 10 a. m., Oct. 1, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at Naval Academy a quantity of tram cars, Schedule 317.

Baltimore, Md.—Pig Lead—Until 11 a. m., Oct. 2, by Alfred M. Quick, Water Engineer, for furnishing 25 tons of Omaha pig lead.

Indian Head, Md.—Crane, Hoist—Until 10 a. m., Oct. 1, by Bureau Supplies and Accounts, Washington D. C., to construct at the naval proving ground, Indian Head, Md., a storehouse, and to furnish and erect therein a traveling crane and hoist. Applications for proposals should refer to Schedule 310.

Jefferson Barracks, Mo.—Boilers—Until 11 a. m., Oct. 1, by O. W. Bell, Q. M., to furnish and install 2 boilers in general mess hall building.

St. Louis, Mo.—Steamboat—Until noon, Oct. 5, by Capt. G. R. Lukesh, U. S. Engrs., for sale to U. S. of one river steamboat, preferably steel hull, about 140 ft. long, already constructed, new or second hand, in good condition, having good accommodations for 6 or more passengers, capable of carrying light freight, and drawing, at full load, not over 4 ft.

Portsmouth, N. H.—Profiling Machine, Timber—Until 10 a. m., Oct. 1, by Bureau Supplies and Accounts, Washington, D. C., to furnish at the navy yard, Portsmouth, N. H., a quantity of naval supplies, as follows: Schedule 291—Profiling machine. Schedule 320—Beech, oak.

Newark, N. J.—Fire Hose—Until 8 p. m., Sept. 26, by R. D. Argue, Secy. Board of Education, for furnishing and installing in the schools where required 5,000 ft. of unlined linen hose, with reels, valves, couplings, nozzles, etc.

New York, N. Y.—Broken Stone—Until noon, Oct. 8, by George Cromwell, President Richmond Borough, St. George, New Brighton, for furnishing and delivering 1,400 tons of 1½-in. broken stone and screenings of traprock.

New York, N. Y.—Hose, Play Pipes—Until 2:30 p. m., Sept. 30, by Robert W. Hebberd, Commissioner Charities, foot of E. 26th St., for furnishing and delivering fire hose and play pipes.

New York, N. Y.—Pipe, Machinery, Etc.—Until 10 a. m., Oct. 1, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard a quantity of supplies, among which are the following: Schedule 291—Engine lathes, boring mill, boring and drilling and milling machines, Universal shaper. Schedule 314—Carbons, incandescent lamps, arc lamp globes, electric wire, dry batteries, electrical supplies, P. & B. varnish, hardware, gauge glasses, hose, packing. Schedule 316——Brass and iron pipe. Schedule 319—Steel bolts and nuts, wood screws, turn-buckles, thimbles, taps, twist drills, files, emery cloth, hardware and tools. Schedule 320—Hackmatack and oak boat knees, spruce, cypress, white and yellow pine, cedar, cherry, poplar, oak. Schedule 323—Brass and copper pipe, hose pipes, valves, etc.

Portsmouth, Va.—Paving Brick—Until 8 p. m., Sept. 30, by City Clerk, for furnishing f. o. b. wharf, 100,000 first class sidewalk paving brick. Bascom Sykes, City Engineer.

Puget Sound, Wash.—Timber, Bolts, Etc.—Until 10 a. m., Oct. 15, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard: Schedule 329—Fir, lumber. Schedule 333—Drift bolts, etc., fir, galvanized iron plates, galvanized sheet steel, Scotch pig iron.

Union, W. Va.—Pipe, Etc.—Until Oct. 5, by Water Works Committee, Town Council, for furnishing 7,500 ft. 5 in. pipe, 900 ft. 4 in. pipe, hydrants, valves, etc.

Milwaukee, Wis.—Special Castings—Until 10:30 a. m., Sept. 27, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for furnishing 50 tons of special castings.

CONTRACTS LET.

The following contracts have been let recently:

Anniston, Ala.—Cement Sidewalks—John Bigler, for 18 blocks of pavement.

Little Rock, Ark.—Ditch and Concrete Work—Crescent Construction Co., Peoria, Ill., at $86,021, for constructing 7 miles of open ditch and 2,635 ft. 84 in. reinforced concrete conduit.

Idaho Springs, Colo.—Reservoir—Thomas & Wilkie, at $20,000, for reservoir in Chicago Creek.

Willits, Cal.—Railroad Work—Western Improvement Co., San Francisco, Cal., is reported to have been awarded first section of extension of Northwestern Pacific from Willits to Eureka.

Denver, Colo.—Sewer System—National Construction Co., at $111,363, for sanitary sewer system in subdistrict No. 8.

West Point, Ga.—Railroad Work—Hardaway & Wright, Columbus, Ga., first 20 miles of Chattahooche Valley Ry., from West Point, north.

De Land, Fla.—Sidewalks, Paving—Georgia Hydraulic Stone Co., 5,000 lin. ft. tile sidewalk; W. C. Cannons, grading and paving Clara ave.

Vienna, Ga.—Water Works—Walton & Wagner, Atlanta, Ga.

Davenport, Ia.—Bridge—Clinton Bridge & Iron Co., Clinton, Ia., steel bridge near Sears Canal, at $7,640.

Fort Madison, Ia.—Masonry Work—George W. Gist, Fort Madison, and Vals Herschfield, Pontoosuc, Ill., masonry work on Nauvoo trolley line.

Iowa City, Ia.—Sewer—John L. Berry, for cemetery sewer.

Rockwell City, Ia.—Ditch Work—Ward Bros., Audobon, Ia., Cedar drain at 6.9 cts.; Canal Construction Co., ditch No. 20.

Aurora, Ill.—Brick Paving—J. E. Salfisberg & Co., 2nd ave., paving at $9,289.

Chicago, Ill.—Pumping Station—B. M. Zadeck & Co., 135 Adams St., erection of Lakeview pumping station.

Chicago, Ill.—Paving—On September 16 the South Park Commissioners awarded a contract to the Chicago Bitulithic Co. for 72,623 square yards of bitulithic for surfacing the present macadam foundation in Michigan Ave., from 22d to 39th St., 33d St., from Michigan Ave. to South Park Ave., and in South Park Ave. from 33d to 35th St.

Oregon, Ill.—Macadamizing—Frank B. Gale, improvement of Washington St. at $14,500 and improvement of 3d St. at $1,700.

Boston, Mass.—Sewer—Bruno & Petitte, Boston, at $2,801, for sewer in Morton St., West Roxbury.

Monticello, Ill.—Paving—John E. Andrew, at $1,721.

Quincy, Ill.—Steel Bridge—George Brandt, for bridge over Feather river, near Beckwith.

Rochester, Ill.—Iron Bridge—Springfield Bridge & Iron Co., Springfield, Ill., at $2,640 for iron bridge.

Huntington, Ind.—Sewer—Philip Hipskind & Sons, at $3.39 per ft., for concrete sewer and $2.30 for vitrified pipe sewer.

Mount Vernon, Ind.—Road Work—Mount Vernon Construction Co., at $41,143.

Princeton, Ind.—Trolley Extension—Jones Construction Co., Terre Haute, Ind., Patoka extension of Evansville & Southern Indiana traction line.

Shelbyville, Ind. — Macadamizing — J. D. Hoss, Indianapolis, Ind., macadamizing East Washington st., at $5,000.

Wichita, Kan.—Steel Concrete Bridge—Canton Bridge Co., Canton, O., at $97,000, for bridge over Arkansas river at Douglas ave.

St. Joseph, Mo.—Brick Paving—G. O. Skilbred, at $1.98, for Delaware st.; Rackliffe & Gibson, at $2.10, for paving Mitchell ave.

Biwabik, Minn.—Electric Light Plant—Burgess Electric Co., at $4,000.

St. Paul, Minn.—Paving, Sewer—Fielding & Shepley, 216 W. University av.; brick paving in alley 10, $1,892; D. W. Moore, 902 Edmund st., grading Troy st., $1,297; Thornton Bros., sewer in Reaney st., $6,786.

Two Harbors, Minn.—Sewers—Thomas & McCoy, two sanitary sewers, at $21,465.

Kansas City, Mo.—Grading, Macadamizing, Etc.—J. Ray Samuel, for grading and macadamizing 68th st., at 30 cts. for grading, $2.05 for macadamizing and $5.50 for bulkhead masonry.

St. Louis, Mo.—Bridge Piers—Missouri Valley Bridge & Iron Co., Leavenworth, Kan., at $385,795, for constructing nine piers for the bridge for the McKinley Interurban Ry. Piers will be sunk 70 ft. below low water mark and will be 130 ft. high.

Great Falls, Mont.—Sewers—Wm. H. Taylor, at $4,165, for constructing three sewers.

Claremont, N. H.—Steel Bridge—United Construction Co., Albany, N. Y., at $21,804 for bridge, over Connecticut River.

Albany, N. Y.—Asphalt Blocks, Paving—Hastings Paving Co., at $69 per 1,000, for furnishing asphalt blocks. Mulderry Bros., at $8,449, contract for improvement of Bradford St.

Butte, Mont.—Sewer—P. Oren, at $2,925.

Rutherford, N. C.—Railroad Work—Contingent to voting bonds by several counties arrangements are said to have been perfected for building a line of railroad from Rutherford to Knoxville. It is said that the construction will be done by the Appalachian Construction Co., recently chartered.

Warrensburg, Mo. — Bridge — Midland Bridge Co., Kansas City, Mo., at $14,747, for 27 bridges for Johnson county.

Vineland, N. J.—Road Work—J. S. Fisher, Clayton, N. J., at $12,000, for road from Malaga to Landis ave., Vineland.

Newark, N. J.—Bridge—Hay Foundry & Iron Works, Newark, at $49,985, for bridge over Morris Canal at Central ave.

Medina, N. Y.—Sewer Outlet—Martin Scanlon, at about $13,000.

Albany, N. Y.—State Road Work—No. 442, Morris Kantrowitz, Albany, N. Y.; No. 407, Molloy & Davis, Schenectady, N. Y.; No. 567, Lane Construction Co., Syracuse, N. Y.; No. 615, Hinman & Sproul, Schenectady, N. Y.; No. 559, Casey & Murray, Rochester, N. Y.; No. 656, Reardon & Byrnes, Glens Falls, N. Y.; No. 601, Gantz-Wilson Construction Co., Buffalo, N. Y.; No. 597, Newport Construction Co.; No. 560, Casey & Murray; No. 461, Newport Construction Co., Newport, N. Y.; No. 545, T. Finch; No. 533, J. T. Finch; No. 400, Whittemore, Rauber & Vincennus, Rochester, N. Y.; No. 399, J. T. Finch, Glens Falls, N. Y.; No. 524, Moshier & Summers, Buffalo, N. Y.; No. 320, H. C. Schroeder; No. 307, Joseph Walker, Albany, N. Y.; No. 362, Alonzo Schaupp; No. 389, Fred W. Knickenburg; No. 390, Fred W. Knickenburg; No. 294, the Monroe Roads Co.; No. 289, E. M. & W. Ferguson.

Cincinnati, O.—Street Work—A. J. Henkel & Bro., macadamizing Arlington St., $8,629; Kichner Construction Co., 8th and Plum Sts., Fairview Ave. work, at $34,575.

Cincinnati, O.—Asphalt Paving—Kirchner Construction Co., at $27,198, for improvement Clinton St.

Marion, O.—Steam Shovels—The Marion Steam Shovel Co., Marion, O., was awarded contract September 9, by the Isthmian Canal Commission for furnishing seven steam shovels, Model 60, at $70,262.50. One Model 20 was shipped last week for the Panama Railroad. At the present time the company is shipping over 30 shovels per month.

Sandusky, O.—Filtration Plant—Thomas Lightbody, Youngstown, O., and W. M. Henderson, Warren, O., for filter plant for this city. Estimated cost is $100,000.

Claysville, Pa.—Paving—Halloran Construction Co., Washington, Pa., at $8,850.

Coatesville, Pa.—Bridge Work — Nolan Bros., Reading, Pa., masonry abuttments and piers for Reading Ry. bridge north of Coatesville; Keystone Structural Co. has superstructure work.

Providence, R. I.—State Road—James D. Watson, at $7,465, for road in East Providence.

Gaffney, S. C.—Bridge—Roanoke Bridge Co., Roanoke, Va., at $9,000, for bridge at Statcy's ferry.

Johnson City, Tenn.—Paving, Sewers, Etc.—Barber Asphalt Paving Co., Philadelphia, Pa., 48,000 sq. yds., at $2.14; S. H. Pouder, sidewalks, curbs, etc., at $5,397; Hassam Paving Co., sewer at $5,852.

Knoxville, Tenn.—Bridge Repairs—J. U. Burkhart, for keeping all wooden county bridges within 5 miles of city in repair.

Nashville, Tenn.—Street Work—J. A. Webb, Buchanan St. work at $3,200, and Bayard Ave. work at $4,120.

Gurley, Tex.—Ditch Work—Charles Peavey, contract for ditching for S. A. & A. P. Ry. to control water of Brazos river.

Houston, Tex.—Bridge—E. P. Alsbury & Sons, for bridge over San Jacinto river, at $6,900.

Centralia, Wash.—Sewer System—Northwest Bridge Co., Tacoma, Wash, at $22,150.

Milwaukee, Wis.—Curbing—City Construction Co., at about $6,000, for curbing 22nd Ave. Boulevard.

PROJECTED WORK.

Railroads.

Items Arranged Alphabetically by States.

Franklin, Ga.—Application will be made for charter for the Coweta, Franklin & Troup Ry. to build a line about 50 miles long, to be operated by steam or electricity, from a point on either the Central Railway of Georgia or the Atlanta & West Point, in Coweta County, via Franklin, Ga., to a point on the Atlanta, Birmingham & Atlantic, in Heard County, Georgia. John W. Daniel, Franklin, Ga.; A. J. Kitchens, Texas, Ga., and W. C. Wright, Newman, Ga., are interested.

Pelham, Ga.—The Bainbridge Northeastern Ry., which is building a railroad from Bainbridge northeast to Pelham, Ga., has filed articles of incorporation. The charter calls for a line 70 miles long, traversing the counties of Mitchell, Thomas, Grady and Decatur, and extending through Florida to a point on the Gulf of Mexico. Principal office is in Bainbridge, Ga.

Fairview, Nev.—Directors of Nevada Hills Mine are perfecting plans for the construction of a railroad from Fairview to Fallon, 40 miles, to connect with the Southern Pacific.

Toledo, O.—Toledo Junction Ry. Co. has been incorporated and proposes the construction of a line about 8 miles long. Clem V. Wagner, C. F. Ferron and M. I. Brown, of Toledo, are interested.

Dallas, Tex.—Charter of Union Central Railroad Co. of Texas has been approved by State Department. Principal offices of company is at Dallas, and it is proposed to construct a road from Dallas through the counties of Dallas, Kaufman, Henderson, Cherokee, Nacogdoches, Anderson, San Augustine and Sabine to a point on the Sabine River, an estimated distance of 225 miles. The incorporators are: W. S. Maple, M. C. Guillitee, W. J. Hogue and W. R. Stout, Dallas; W. H. Marsh, Tyler; J. J. Stubbs, T. B. Poindexter, Wortham; J. B. Gordon, Fairfield; H. H. Hyde, Houston; James A. Lucas, Edgewood.

Charleston, W. Va.—A charter has been issued to the Gauley & Birch River Railroad Co., which will build a railroad from the mouth of Muddlety Creek in Nicholas County, by way of Hookerville to a point at or near the mouth of Big Birch river. The authorized capital stock is $300,000. The incorporators are: Arthur G. Vaughn, of Poe; R. H. Hamilton, Walter C. Reddy and John D. Anderson, of Summersville; William O'Conor and John G. Malcolm, of Kesler's Cross Lanes.

Elkins, W. Va.—Location surveys have been completed and construction work will be begun soon, it is said, in the road of the Loop & Lookout Railroad Co., recently chartered with an authorized capital stock of $100,000 for the purpose of developing a coal tract of 100,000 acres of timber land in Greenbrier and Fayette Counties. The incorporators are: T. W. Raine, W. W. Raine, L. R. Preyz, J. M. Raine and S. J. Snyder.

Electric Railroads

Items Arranged Alphabetically by States.

Decatur, Ala.—North Alabama Traction Co. will expend $10,000 in improvements here.

Birmingham, Ala.—Local reports state that the projects of the Tidewater Development Co. are about to be taken over by a new company to be called the Birmingham & Gulf Ry. & Navigation Co. This, it is said, assures the construction of electric freight and passenger railway from Gadsden to Tuscaloosa. Prof. J. W. Dewberry is reported to be interested.

Little Rock, Ark.—Surveys are under way for an interurban line to connect Little Rock and Pine Bluff. J. J. Finke, Pine Bluff, Ark., is President.

Waterbury, Conn.—Sanderson & Porter, Engineers, 52 William St., New York, are making surveys for proposed trolley road between Milldale and Waterbury.

Pueblo, Colo.—Surveys have been started by N. C. Vanatta, Chief Engineer, for the new Douthitt electric interurban, which is to be built from Pueblo down the Arkansas River to Fowler.

Davenport, Ia.—Davenport & Manchester Interurban Ry. Co., capitalized at $15,000, has been incorporated by T. F. Halligan, Henry Vollmer and others.

Hartley, Ia.—Corporation has been formed here to take up the project for an interurban line between Spirit Lake and Sioux City. Frank Patch, Hartley State Bank, Hartley, is President.

East Alton, Ill.—W. Rudsill, an engineer of Bunker Hill, Ill., has asked franchise for street railway through this place. It is stated that the projected line will run from Bunker Hill through Bethalto, Oil City and East Alton to Alton, a distance of 20 miles.

Independence, Kan.—Independence North & South Ry. Co., capitalized at $10,000, has been chartered, its purpose being the construction of an electric railroad from Kansas City, Kan., to Caney, Kan. The company is also given the right to construct railroad, telegraph and telephone lines, together with electrical power plants. C. S. Leeds, Kansas City, Kan., F. C. Daniels, Kansas City, Mo., and H. F. Guthrie, Topeka, Kan., are interested.

Red Lodge, Mont.—Board of Trade has voted to secure engineer to make estimate of cost of building an electric railway from Red Lodge to Bear Creek Coal Mining Camp, 4 miles away.

Canandaigua, N. Y.—Canandaigua Southern Electric Ry. Co. has plans under way for extending its road from Atlanta to Wayland. Geo. H. Switzer, Bath, N. Y., is President.

Rochester, N. Y.—Preliminary surveys have been made of a portion of the route of the Rochester, Scottsville & Caledonia Ry. It is understood that the line will begin at Rochester, running through private right of way to Scottsville, Caledonia, LeRoy, and Pavilion, from which latter place branches will be run to Warsaw, Rock Glen, and Perry and Letchworth Park at Glen Iris. Elliot Strahy, Rochester, N. Y., is Chief Engineer.

Fairview, Nev.—Nearly $20,000 has been raised here by popular subscription toward building an electric railway to connect the town with the leading properties of the mining district. E. D. Lidstone is interested.

Grand Forks, N. Dak.—Ordinance is before City Council to grant Northwestern Interurban Ry. Co. franchise for construction and operation of a street railway in this city. The company proposes to construct a line from Grand Forks to Carrington and to use it in connection with the local system.

Donora, Pa.—Borough Council has granted Webster Street Ry. Co. franchise for building line between Donora and Eldora Park.

Lancaster, Pa.—Management of Lancaster, Oxford & Southern R. R. is said to have decided to convert the road into an electric railway, securing power from McCalls Ferry Power Co. The road is 28 miles long. W. M. Franklin, Lancaster, Pa., is President.

Pittsburg, Pa.—Pittsburg Railways Co. has completed plans for an extension of its interurban system from Finleyville on the Pittsburg-Charleroi line to Bentleyville, Washington County, and thence to Waynesburg.

Everett, Wash.—Everett & Cherry Valley Traction Co., capitalized at $1,500,000, has been incorporated and proposes to build and operate a railway line and telegraph and telephone lines from near Snohomish to Fall City. Headquarters will be at Everett and J. T. McChesney and F. W. Brooks are interested.

Electric and Gas Plants.

Items Arranged Alphabetically by States.

Ashdown, Ark.—T. C. Aubrey of Verda, La., is forming stock company here for the purpose of establishing light and ice plant at this place.

Fort Smith, Ark.—Fort Smith Light and Traction Co. is planning to spend $50,000 in improvements for the power house.

Ozark, Ark.—An electric light company has been organized by A. Bueglar, Alfred Sax, John J. Sax and others.

Columbus, Ga.—Isuance of $100,000 for municipal electric light plant is proposed.

Americus, Ga.—Charter has been granted to the Americus Railway & Power Co., capitalized at $250,000, which will build four miles of street car line, put in a thoroughly up-to-date lighting plant and in addition will pump water for the city for the next 20 years.

Jacksonville, Ill.—Construction of electric light plant here is proposed.

Dubuque, Ia.—Peterson Heat, Light & Water Co. of Des Moines, is asking a franchise here for a heat distributing system.

St. Ansgar, Ia.—St. Ansgar Light & Power Co. has been incorporated by A. N. Lund and others. Capital stock is $10,000.

Seeleyville, Ind.—Frank Fauvre, Indianapolis, Ind., proposes to establish electric power plant near here.

Forest, Miss.—Electric light plant for this place is now said to be assured.

Syracuse, Ind.—Plans are being considered for enlarging the plant of Syracuse Power, Light & Supply Co.

Cambridge, Md.—Franchise has been granted John H. Burgess, Jr., and William H. Medford, for an electric light plant.

Escanaba, Mich.—Representing southern Michigan capitalists, F. E. Hatch, of Pellson, Mich., has secured an option on Boney Falls, 20 miles north of Escanaba, on the Escanaba River, and it is expected that he will acquire the rapids shortly and will early commence their development for water power purposes.

Cleveland, O.—The Cleveland Electric Illuminating Co. will build a generating plant on the lake shore.

Granite, Okla.—The Granite Electric Light & Power Co. of this city, has been incorporated with a capital stock of $10,000 by K. C. Cox, H. J. Hayes, A. Hindert and others.

South Bethlehem, Pa.—South Bethlehem merchants and business men are planning the construction of a plant for the generation of lighting current for their use.

Palestine, Tex.—W. B. Johnson and Geo. R. Cooke have asked for a franchise for a new electric light plant and power plant in this city.

Memphis, Tenn.—Resolution will come before City Council asking for immediate construction of municipal light plant.

Heber, Utah.—Jesse Knight, Provo, Utah, is reported interested in formation of company to erect a power plant near here.

Pittsford, Vt.—Vermont Marble Co., Proctor, Vt., is having surveys made near Furnace Brook in Pittsford, with object of erecting power plant.

Blaine, Wash.—Blaine Water & Power Co. has been incorporated by J. J. Crites and others. Capital is $50,000.

Sewers.

Items Arranged Alphabetically by States.

Bessemer, Ala.—A $25,000 storm sewer bond issue has been voted.

Elyton (P. O. Birmingham), Ala.—Construction of trunk sewer is under consideration. Frank Smith is Mayor.

Ensley, Ala.—Sewers are to be constructed in the 6th Ward at a cost of about $20,000. F. D. Sugg is Mayor.

Colusa, Cal.—Town Trustees are considering installing sewer system.

Santa Monica, Cal.—Council is considering plans for sewage disposal system.

Willows, Cal.—City sewer system advocated. Henry Biller is Chairman Trustees.

Emmetsburg, Ia.—Four blocks length of sewer is to be constructed here.

Elgin, Ill.—A sewer to cost $3,118 is proposed for Walnut Ave.

Saint Charles, Ill.—Surveys are underway for sewer system for this place.

Cairo, Ill.—Seven streets are to be improved by filling and sewering at a cost of about $80,000.

Brazil, Ind.—City Engineer Fletcher is preparing plans, etc., for sanitary sewer system for south side of city.

Decatur, Ind.—Council has ordered construction of C. D. Lewton sanitary sewer.

Riverside, Ind.—Town Board has ordered construction of sewer in Jersey St. to cost about $1,800.

Dayton, Ky.—City Engineer Lindsey has about completed surveys and estimates for a sewer system for this city. Cost will be about $100,000.

Turners Falls, Mass.—Special town meeting was held on Sept. 17 to hear report on projected sewer system for High St. C. W. Hazelton is chairman committee.

Ishpeming, Mich.—Council is considering making sewer extensions to cost $5,000.

Cadillac, Mich.—City has accepted plans of George Pierson, Engineer, Kalamazoo, Mich., for sewage disposal plant, and bids for the work will be aked at once.

Kansas City, Mo.—George Hoffman, President Board Public Works, is advocating securing expert to lay out a new sewer system to cost about $600,000.

Bozeman, Mont.—City may be obliged to construct a septic tank to cost several thousand dollars.

David City, Neb.—City Council has accepted plans and specifications for a new sewer system.

Madison, N. J.—Special election will be held October 14 to vote on constructing sewer system and disposal plant.

Atlantic Highlands, N. J.—The State Sewerage Commission, with a view to avoiding pollution of Atlantic Ocean, has decided to have some municipalities along the coast remove their sewer extension in the ocean or bays and install sewage disposal plants. In accordance with this order this borough will have to construct a $5,000 sewage disposal plant.

Riverside, N. J.—A $80,000 bond issue has been voted for a sewer system.

Ventnor (P. O. Atlantic City), N. J.—Council is considering buying local sewer system and improving it.

Hartwell (P. O. Cincinnati), O.—Village may vote at November election on issuing bonds for $70,000 sewer system.

Portsmouth, O.—Board Public Works has ordered construction Drew storm sewer; also sewer at 10th and Chillicothe Sts., and in Jackson St.

Stillwater, Okla.—Preliminary surveys have been completed for sewer system here.

Chandler, Okla.—This place has voted against issuing bonds for sewer system.

Altoona, Pa.—Mayor has recommended construction of large concrete sewer.

Titusville, Pa.—Additional sewers are to be constructed.

York, Pa.—The $750,000 municipal improvement loan proposition was defeated at special election Sept 10. It was proposed to use $100,000 of above sum for completing sewer system.

Carlisle, Pa.—State Health Department has issued permit to Carlisle to construct sewer system and sewage disposal works in accordance with plans submitted.

NOTICE TO CONTRACTORS.

Sealed bids are desired until Sept. 30, 1907, at 8 p. m., for laying 1,620 feet ten-inch, 3,804 feet eight-inch, 18,130 feet six-inch and 33,500 feet four-inch cast iron water pipe, all 3½ feet deep. Setting 84 hydrants, 67 gate valves, 1,500 feet four-inch hydrant connections, and 20,000 pounds special castings. All material to be furnished, delivered and laid.

Specifications on file with the City Clerk of Du Quoin, Ill.

Address Board of Local Improvements, or I. R. Spilman, Atty., Du Quoin, Ill.

SUBSTRUCTURE AND SUPERSTRUCTURE S. ASHLAND AV. TEMPORARY BRIDGE.

Department of Public Works,
Chicago, September 16, 1907.

Sealed proposals will be received by the city of Chicago until 11 a. m., Saturday, September 28, 1907, at room 224, City Hall, for furnishing and delivering all necessary material and building in place the new substructure and superstructure for a temporary highway bridge over the west arm of the south fork of the south branch of the Chicago River near South Ashland Ave., according to plans and specifications on file in the office of the Department of Public Works of said city, room 326, City Hall.

Proposals must be made out upon blanks furnished at said office and be addressed to said department, indorsed "Proposals for South Ashland Av. Temporary Bridge," and be accompanied with five hundred dollars in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago and made payable to the order of the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Public Works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

JOHN J. HANBERG,
Commissioner of Public Works.
By PAUL REDIESKE,
13-1t Deputy Commissioner.

ASPHALT PAVING.

Enid, Okla.

Sealed bids will be received at the office of the City Clerk of the City of Enid, Oklahoma Territory, until 12 o'clock noon Friday, October 11, 1907, for grading, paving, curbing, guttering, draining and otherwise improving certain streets, in accordance with laws regulating the same, and certain resolutions, ordinances and other actions of the Mayor and Council of the City of Enid, Oklahoma Territory, relative to the same, to-wit:

Grand avenue, from the north line of Randolph avenue to the north line of Walnut avenue. Walnut avenue, from the west line of Grand avenue to the east line of Independence avenue (to be paved with asphalt), about 11,500 square yards.

Plans and specifications on file at the office of the City Clerk and the City Engineer.

A certified check in the sum of $1,000 on some bank in the City of Enid will be required to accompany each bid, as a guarantee of good faith, and which shall be forfeited to the City of Enid should the bidder to whom the contract is awarded fail to qualify and enter into contract within ten days after acceptance of bid by the Mayor and Council.

A bond in the sum of 50 per cent of contract price will be required of the contractor for the faithful execution of the work and the protection of the city, and all property owners against any loss or damage caused by the negligent execution of such work.

A guarantee contract for maintenance of the above work for a period of ten years will be required of the contractor, as required in the specifications.

Bids will be opened by the Mayor and Council at the Council Chamber, at 8 o clock p. m. on said 11th day of October, 1907, at which time and place bidders are required to be present.

The Mayor and Council reserve the right to reject any or all bids and readvertise if it should be deemed to the best interest of the city and the property owners.

E. R. LEE,
C. H. SEXTON, City Clerk.
City Engineer. 13-2t.

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WANTED—Names of abrasive manufacturers who use garnets. A. C. Seward, 6 The Dunbar, Toledo, O.

WANTED—Conveying machinery, with electric motor, to carry food from kitchen, through a tunnel, to dining rooms, at new Parental Home buildings. Address Frank A. Collins, 69 Broadway, Flushing, N. Y.

WANTED—Catalogs and other information concerning the construction of lime kilns, especially those having steel shells and built to use crude oil fuel. N. C. Ray, Merced, Cal.

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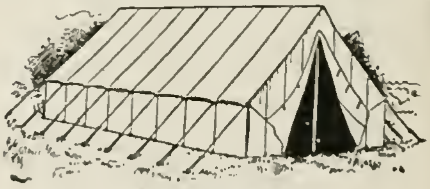

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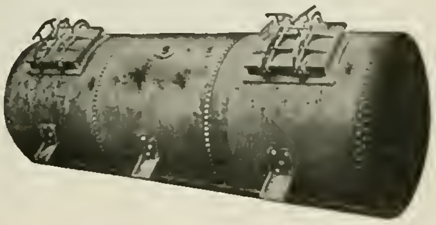

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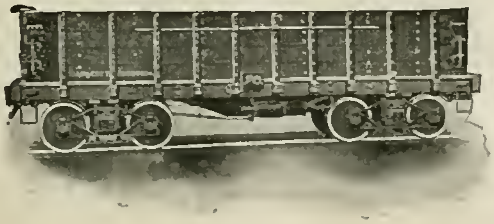

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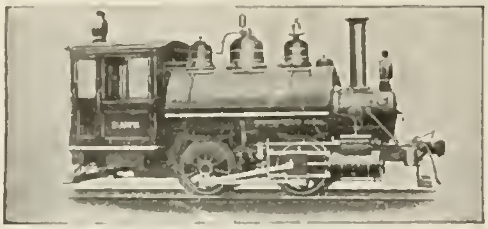

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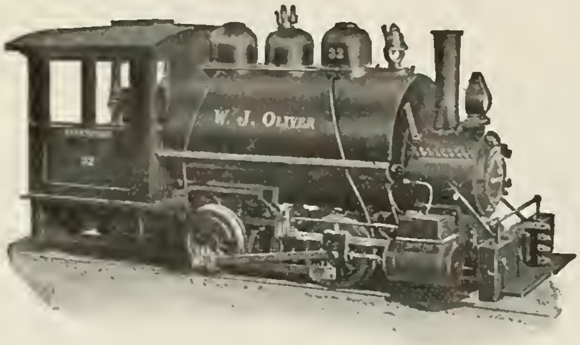

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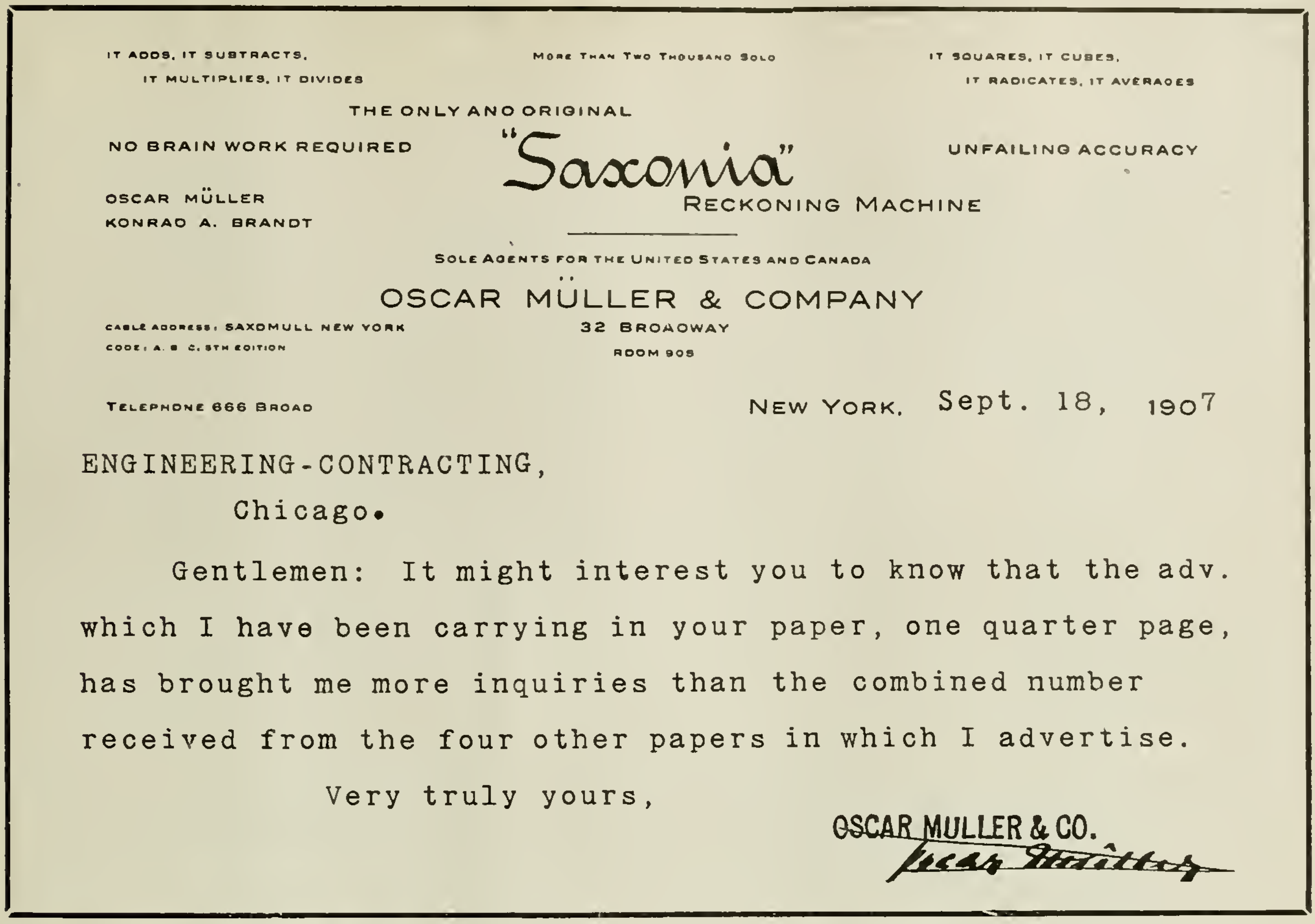

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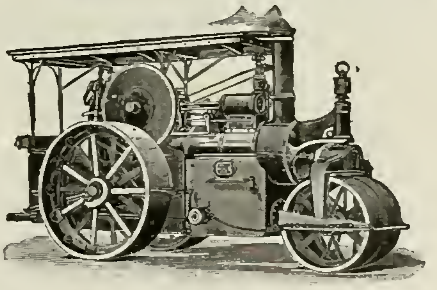

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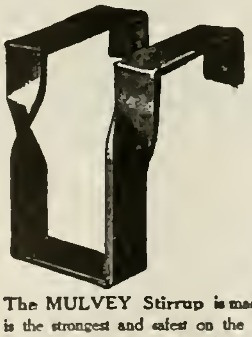

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One Danger of Rushing Contract Work.

There is a well founded belief that it pays a contractor to establish a reputation for rushing his work to a finish; but, in the effort to maintain such a reputation, a contractor may easily make a serious mistake. We refer to the mistake that is made in antagonizing the workmen. For example, if workmen are hired in large numbers to do a comparatively small piece of work, the job is no sooner well under way than it is finished. The men who are then discharged spread the history of the job among their fellows, and the contractor soon discovers that it is very difficult, if not impossible, to hire first-class men. This is particularly true if the contractor has been in the habit of hiring a host of men intermittently, which often happens on a large job where the materials are delivered in dabs. When a small amount of material is delivered, it is generally poor policy to put so big a gang at work that the materials are likely to be used up before another consignment can arrive. Nothing irritates a good workman more than intermittent occupation. Bearing this in mind, a contractor should plan to keep a certain number of good men steadily at work. Then, when he feels sure that there will be more than enough material to keep them busy, he can pick up more men. By following this plan he will have at least a number of men who will stand up for him as being a contractor who is considerate of his employees. This may seem like a trivial matter, but it is really of far more importance than many a contractor thinks it to be.

Wherein Engineering Differs from Other Professions.

Each brain is a family of faculties, some members of which are always in short trousers. It is not strange, therefore, that certain puerile ideas persist among men as a class even as they do among individuals. In the juvenile state of society, some classes of men came to be known as "professional men." These men made codes for their own guidance, and among the laws laid down was the one enjoining any professional man from soliciting patronage. Doctors and lawyers who sought business became "quacks" and "shysters." When the profession of engineering first came into existence, engineers failed to perceive that an engineer is a professional man *and more*. So they aped many of the rules of the older professions. An engineer is, or should be, a business man. His is the task always to be solving equations in economy. An engineer is, or should be, an inventor. Indeed, the word engineer is closely akin to ingenious. In French, the two words are almost identical.

An engineer is clearly more than a professional man. As a man of business he may push himself to the front. He may solicit work for himself. He may enter the arena of politics. He may seek to be a member of a public commission, or he may strive to be elected president of a railway. He *may* do these things, and, in our opinion, he *should*, if his inclination points that way. We say he should, because we believe society will be better off when there are more engineers as mayors of cities, as members of public service commissions, and as presidents of railways. These positions rarely come to the man whose modesty, or whose "code," prevents him from seeking them. Luck has smiled on the face of a few engineers and has said: "Come, take my hand, I will lead you to a position of prominence." Upon inquiry we have found that, in every case, the voice of Luck was merely the voice of a man talking to himself.

Engineer's Estimates Should Be Made Public

The rejection of bids because they are higher than the estimated cost of the work as made up by the engineer is without doubt an injustice to the contractors bidding, as we have previously pointed out in this journal. When the engineer's estimate, either in detail or in the aggregate, is kept secret no one has any idea whether or not it is a reasonable one.

When all bids are higher than the engineer's estimate it is more than likely that the estimate is erroneous, or else the engineer is in possession of information regarding the work that has not been made known to the contractors. The contractor suffers seriously from the rejection of a bid simply because it exceeds "the estimate." He has spent both his time and money, and has given to his competitors his prices. There is danger of another evil resulting from keeping secret the engineer's estimate. Suppose one firm puts in a bid way below the engineer's estimate, not knowing what the estimate is, and the next bidder is only slightly below the estimate. When the bids are opened these two bidders may see the advantage of "getting together," and, by making representations as to an error in making up the lowest bid, secure an award to the higher bidder. This, it is true, might occur even where the engineer's estimate is kept secret; but it cannot occur where the estimate is made public and a limit set upon the permissible deviation from the estimate.

On the Erie Canal improvement in New York state, the State Engineer's estimates are made public, and notice is given to bidders that bids must not depart 20% in any single item, nor more than 10% on the total, from the engineer's estimate. The object of this is to prevent unbalanced bids, and to prevent bidding that is unreasonably high or unreasonably low. This seems to be a step in the right direction, at least for certain classes of contract work. Under such conditions a con-

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tractor can easily decide whether it is worth his time to bid, and the state officials know beforehand that they will not be compelled to award a contract to a bidder that has made a ridiculously low bid as compared to the estimate of the engineer.

Macadam Road Construction.

We print in this issue an abstract of an article by Mr. A. L. Valentine relating to the construction of macadam roads. The article contains some very interesting data as to the cost of construction and it is one of the few articles that we have ever seen that states the number of gallons of water required for sprinkling a given amount of macadam during construction.

We note that Mr. Valentine states that macadam work should be started at the end of the road farthest from the source of supply of broken stone. This is a common specification, but one that we believe to be erroneous. We use the word erroneous not in the sense that it is impossible to produce a good road in this manner, but in the sense that it is impossible to produce the most economic road of standard quality.

One of the editors of this journal has had occasion to build a number of macadam roads, and in every case has begun the construction of the work at the point nearest the source of rock supply instead of at the farthest end of the road. The object in beginning near the source of supply is obviously to provide a roadway over which the materials can be hauled to the point of construction. In this manner it is possible to haul two or three times as great a load on the wagon as can be carried by the same wagon when hauled over the bare ground. The longer the haul the more important this factor of cost becomes, but in any case it is a very large percentage of the total cost.

The objection to this method is, as stated by Mr. Valentine, the danger of cutting up the road before it is fully hardened by the rolling process. This objection is overcome by requiring all loaded wagons to pull off to the side of the road at a point 200 or 300 ft. back of the farthest end where the roller is working. Then the wagons have to move only a short distance over the bare earth and the team by exerting itself can usually reach the end of the road without the assistance of a snatch team. Where conditions are such that the team cannot pull the short remaining distance over the bare earth, it is good practice to haul the load directly over the unfinished macadam, provided the wagons are equipped with wide tires, as all wagons used in road construction should be. The wide tires, particularly if the rear wheels do not track with the front wheels, serve to consolidate the roadbed even better than the roller does and actually improve the road instead of causing it to become cut into ruts.

Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Method and Cost of Constructing Reinforced Concrete Kiln House of Separately Molded Members, Edison Portland Cement Co.

One of the most interesting applications in the United States of separately molded members in reinforced concrete mill building construction, has recently been made by the Edison Portland Cement Co., in constructing a new kiln house for its works at New Village, N. J. We are able to give the methods and cost of constructing this building. In the way of preface we may say that this type of construction, that is construction with separately molded members, has had more extended applications abroad and has met with considerable favor from European engineers, while American practice presents at least two other notable examples, one the four-story building for the Textile Machine Works at Reading, Pa., in which the Visintini system was used, and the other a set of one-story warehouses for the Bush Terminal Co., in Brooklyn, New York city.

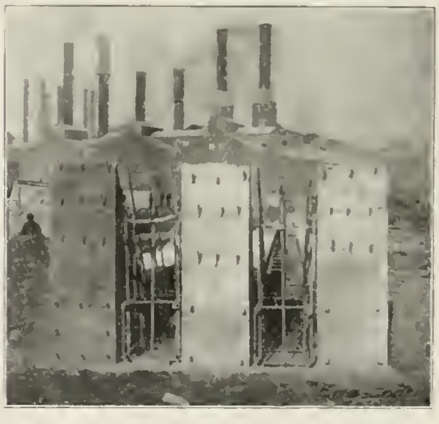


Fig. 1. Arrangement for Molding Four Single Bracket Columns and Four Roof Girders.

General Description.—The new kiln house of the Edison Portland Cement Co. is nominally two buildings, but as the two are so constructed as virtually to be one structure the construction will be so considered here. The combined building is rectangular in plan, 100 ft. wide and 228 ft. long, c. to c. of columns. The roof, which is 27 ft. clear height to bottoms of roof girders is carried by seven longitudinal rows of columns spaced c. to c. of columns, 18 ft. 4 ins., 13 ft. 4 ins., 18 ft. 4 ins., 19 ft., 12 ft. and 19 ft. The column spacing in each row is uniformly 12 ft., c. to c. The roof girders are 50 ft. long and two placed end to end span the building transversely resting on the seven columns. On these girders were placed 12 ft. x 6 ft. 3 in. roofing slabs 4 in. thick. In addition the columns in the center row were bound together at the tops by 8 x 24-in. struts. With the exception of two columns all columns, girders, slabs and struts were cast separately and erected a member at a time.

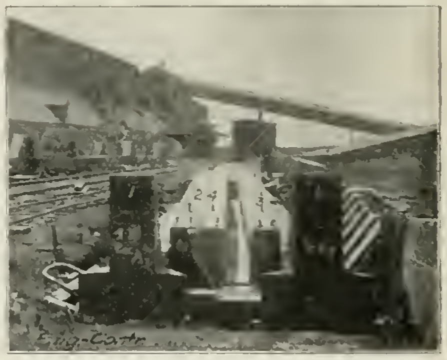


Fig. 2. Arrangement for Molding Four Bracket Columns and Four Roof Girders.

The several members specified were simple structurally. The columns were 16 ins. square with brackets for the girder ends cast in place. The mill columns had one bracket; the center row columns had four, two for the roof girders and two for the struts, and the intermediate columns had two. The column steeples were reinforced with four twisted steel rods bound together with circumferential ties at about 18-in. intervals and the brackets were reinforced as cantilevers. The roof girders were 12 ins. thick, 42 ins. deep at the center and 24 ins. deep at the ends The struts were 8 x 24 ins. in sections. The 12-ft. x 6-ft. 3-in. slabs were reinforced by a grid of 15½-in. longitudinal rods and five transverse rods. The shapes of the several members are clearly shown by the various illustrations.

Methods and Cost of Molding.—The first task in molding the several members was to prepare a suitable molding bed. Concrete was used as being cheaper than wood. An 8-in. foundation of cinders was first laid, leveled off, well soaked and tamped. On this 4-in. concrete slabs 7 ft. wide and 50 ft. long were constructed. This was the first construction. After a few slabs had been constructed, the idea was conceived of forming these base slabs so that they might be of some future use. Another building to be constructed suggested the way. By separating the concrete from the cinder bed with paper and introducing separating strips of wood each base slab 50 ft. 8 ins. long, 7 ft. wide and 4 ins. thick was divided into five slabs 7 x 10 ft. x 4 ins., which would serve as roof slabs for the proposed building. This was the manner in which all the base slabs after the first two or three, were constructed.

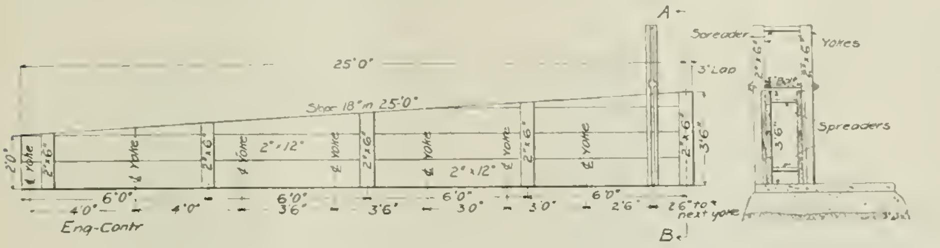


Fig. 3. Details of Forms for Roof Girders.

Several combinations of arrangements were used for molding the columns and girders. For the wall columns having one bracket the arrangement shown in Fig. 1 was adopted. The base was covered with paper and on this the two outside and the middle columns were cast in forms. When these columns had set the forms were removed, the intervening spaces prepared and the two intermediate columns molded. Ten columns, five sets of two columns in lines were cast on each base. For molding the remaining columns the arrangement shown in Fig. 2 was adopted. Two outside lines of columns (4 columns) were molded in forms as in Fig. 1 and between them four roof girders were molded, the sequence of operations being as follows: The two outside lines of columns were molded in forms, allowed to stand until set, and then stripped. Using a column surmounted by a shallow side form for one side and a full depth side form for the other side, molds were formed for the two outside girders Nos. 2 and 3. One full depth side form and the side of girder No. 2 formed the mold for girder No. 4. Girder No. 5 was molded in the space between girders No. 3 and No. 4. Whenever a cast member constituted a part of the form the concrete surface was papered. The struts were cast by a similar arrangement: that is, two lines of struts were molded on the outside and between them four girders were molded.

The forms used, except those for the brackets, were of the simplest construction, consisting merely of sides of boards held together by strips and supported by knee braces, yokes and spacers of wood. Fig. 3 shows a half of one side form for a roof girder. Altogether eight column forms and three girder forms were made, each column form being used seven times and each girder form ten times.

The following figures give the cost of erecting a column form when the whole form (both sides) was of wood. When the column was molded between other columns this cost was eliminated:

1 carpenter 3 hrs. at 25 cts.	$0.750
1 helper, 3 hrs. at 17½ cts.	0.525
1 helper 1 hr. at 17½ cts.	0.175
1/5 boss carpenter 3 hrs. at 30 cts.	0.180
Total	$1.630

Fig. 4. Handling Roof Slabs With Locomotive Crane.

This cost is the cost of form complete, including lining, plumbing, bracing and yoking, but excluding cost of materials and labor constructing.

The cost of erecting a girder form consisting of four pieces like that shown by Fig. 3 was as follows:

2 carpenters 5 hrs. at 25 cts.	$2.500
2 helpers 5 hrs. at 17½ cts.	1.750
2 laborers ½ hr. at 15 cts.	0.150
¼ boss carpenter at 30 cts per hour.	0.375
Total	$4.775

The work included lining, plumbing, bracing, yoking and setting six bolts. The laborers were used in handling the forms. The reinforcement for both columns and girders was erected complete inside the form. The cost of erecting this reinforcement for one column was as follows:

2 laborers, 4 hrs. at 15 cts.	$1.20
1/3 foreman, 4 hrs. at 22½ cts.	0.30
Total	$1.50

This cost included the work of bending the hoops made by ⅜-in. round iron; there were 18 hoops in each column. The girder forms were assembled by piece work at $1.80 per girder.

The concrete was a 1-6 mixture of Portland cement and crusher run stone, no sand being used. The crushed stone ran very fine, the largest passing a ½-in. sieve and 10 per cent passing a 200-mesh sieve. No trouble was experienced with this fine aggregate. The concrete was mixed in a No. 2 Ransome mixer, elevated so as to deliver the batches into cars on a standard gage track. This track ran between the base slabs on which the molding was done. Each car held about 3 cu. yds., and discharged through a side gate and spout directly into the forms; the mixture being made so wet that it would flow readily.

The cost of mixing the concrete was as follows per cubic yard:

Item.	Per cu. yd.
1 foreman at 20 cts. per hr.	$0.0300
3 laborers shoveling stone at 15 cts. per hour	0.0675
3 laborers filling hopper at 15 cts. per hour	0.0675
1 laborer bringing cement at 15 cts. per hour	0.0225
1 laborer dumping cement at 15 cts. per hour	0.0225
9 H.P. at ½ ct. per H.P. hour	0.0450
Superintendence, repairs, etc.	0.0270
Total	$0.2810

The company used its own cement and stone for concrete and assumed the cost of cement at $1 per barrel and the cost of stone at 60 cts. per cu. yd. At these prices and assuming that a cubic yard of concrete of the mixture described above would contain about 1.25 bbl. of cement and 1.5 cu. yd. of aggregate, we have the following cost of materials per cubic yard of concrete:

1.25 bbls. cement at $1	$1.25
1.5 cu. yds. aggregate at 60 cts	0.90
Total	$2.15

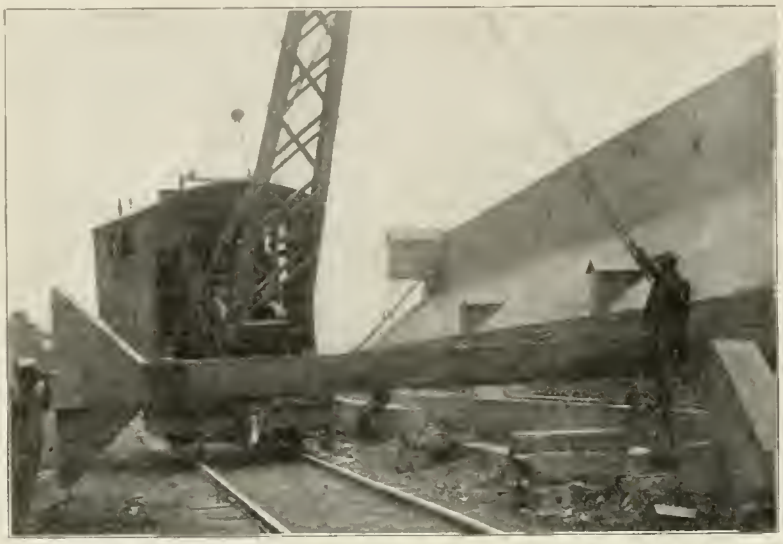


Fig. 5. Method of Handling Columns With Locomotive Crane.

The roof slabs 12 x 6¼ ft. x 4 ins. were molded in tiers as indicated in Fig. 4, a simple rectangular wooden form being used Each slab as it was molded was prepared on top; the form was then moved up and another slab molded. To give a grip for the lifting irons each slab was molded with a 3-in. overlap as shown in Fig. 4. Fourteen roof slab forms were made and each was used 18 times. The cost of molding one roof slab, including materials, forms and labor, was as follows:

Materials.	Per Slab.
1 bbl. cement at $1	$1.0000
1.06 tons stone at 60 cts	0.6360
116¾ lbs. steel at 2¼ cts	2.6470
Total	$4.2830
Forms.	
Lumber and making forms	$0.1040
92 sq. ft. paper at 33 1/3 cts. per 500 sq. ft.	0.0550
Labor erecting and taking down forms	0.5625
Total	$0.7215
Mixing, Hauling and Placing Concrete:	
Mixing	$0.2220
Hauling	0.0250
Placing concrete and reinforcement	0.1700
Total	$0.4170
General Expenses:	
Housing and heating	$0.7000
Superintendence, power, etc. (10%)	0.6120
Total	$1.3120
Grand total	$6.7335

Each slab covered an area of 75 sq. ft., making the cost of the molded slabs about 9 cts. per sq. ft. or $9 per square (100 sq. ft.)

Methods and Cost of Erection.—The columns were erected by means of a locomotive crane. The crane lifted the column from the molding bed, loaded it into flat cars running to the work and then hoisted it into position. Fig. 5 shows the clamps and the location of the attachments employed in handling the columns. To facilitate lifting the column from the molding bed a 1½-in. pipe 8 ins. long was cast into both ends at the center. Pins inserted in these sockets gave hitches for the crane tackle. The column was then raised and blocked up and the clamps adjusted. All columns were erected before the placing of the roof girders was begun. A gang of 1 foreman and 14 men erected from 5 to 7 columns per 10-hour day.

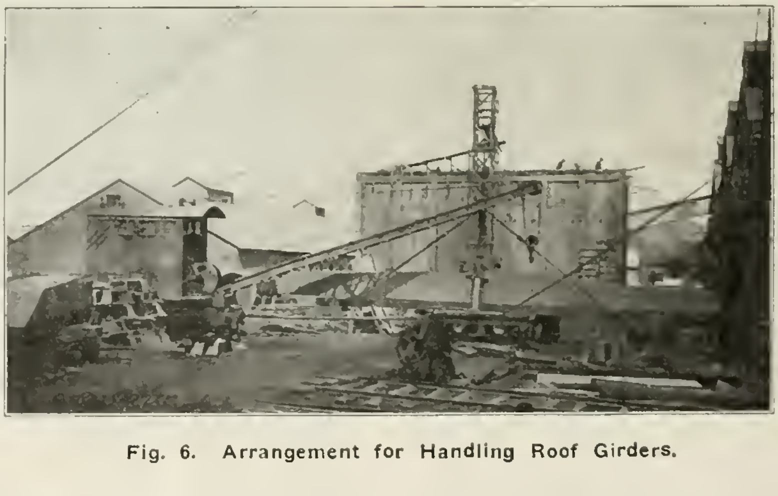


Fig. 6. Arrangement for Handling Roof Girders.

The roof girders were lifted from the molding bed and loaded on the cars by the locomotive crane; at the work they were erected by means of a gin pole. Figure 6 shows the crane loading a girder on the car, and, Fig. 7 shows the gin pole hoisting it into place on the columns. To enable the girders to be raised from the casting bed 1-in. eye-bolts 24 ins. long were cast into them about 4 ft. from each end. They were raised high enough to permit the placing of a 14-in. block under each end. The hoisting sling was then adjusted. This sling is shown by Fig. 6. A 10 x 12-in. timber 35 ft. long with a 2 x 6-in. block nailed to the top side near each end was placed centrally under the girder. Two 1-in. wire ropes were looped under the ends of the timber where they were held by 8 x 8-in. bolted blocks and these upper ends brought together by a clevis directly over the center of the girder. A vertical timber was then inserted between the chain and the top of the girder and wedged tight. The sling was thus transformed into a truss. At first the vertical strut was not used, but it was discovered that when the girder was loaded on the car with overhanging ends, these ends acting as cantilevers started minute cracks in the top of the girder. The truss arrangement was then adopted and no further trouble resulted. After loading, each end of the girder was wrapped with water soaked burlap and in this fashion was transported to the work and hoisted to position. The gin pole used for hoisting was 80 ft. 10 ins. long; 24 ins. diameter at the bottom and 17 ins. diameter at the top. A 50-H.P. Mundy reversible hoisting engine operating a ⅝-in. wire rope turned six times, did the hoisting. The girders were set on the column brackets on a 2-in. mortise joint of 1-3 mixture. Previous to placing the mortar the tops of the columns had been well soaked with water and because of the burlap wrapping the ends of the girders were also thoroughly wet. As soon as a girder was seated the struts between columns was placed; the struts were carried to the work and hoisted by the locomotive crane. Nearly all the girders were in place before the roof slab erection was begun. A gang of 15 men erected four roof girders with struts per 10-hour day.

The roof slabs were raised from the casting beds by means of the locomotive crane and special clamps, shown by Fig. 4, and loaded onto cars. Eight slabs made a car load which was taken to the work where the slabs were hoisted by the gin pole one at a time and loaded onto a handcar running on a track built on timbers laid on the tops of the roof girders. A small derrick on rollers picked the slabs from the handcar and set them in place. A gang of 15 men erected from 18 to 20 slabs per 10-hour day.

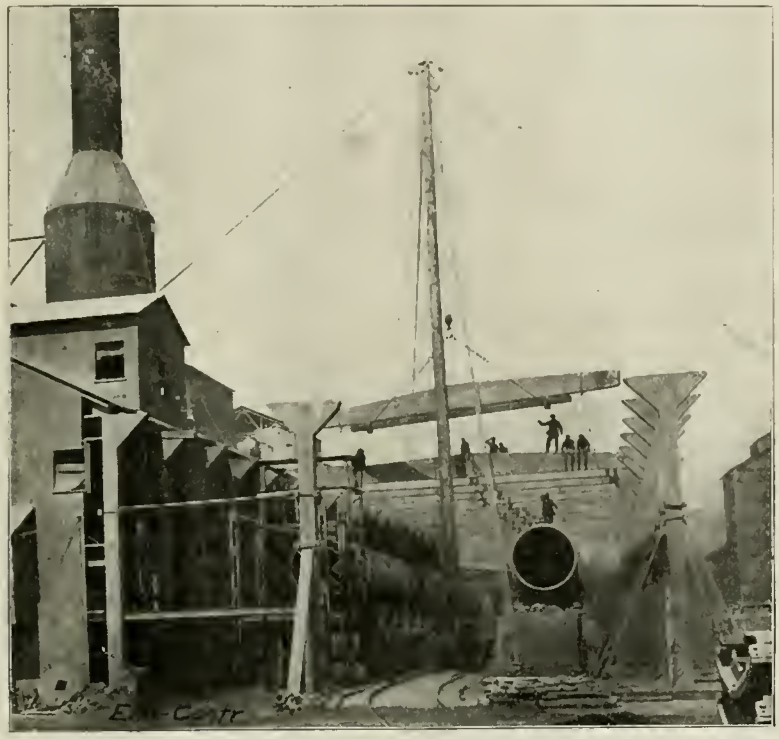


Fig. 7. Erecting Roof Girders on Columns.

The labor cost of erecting the several members was about as follows:

Item.	Total	Per Unit.
15 men at $2.10 (5 to 7, av. 6 cols.)	$31.50	$5.25
15 men at $2.10 (4 girders with struts)	31.50	7.87
15 men at $2.10 (18 to 20 av. 19 slabs)	31.50	1.66

The erecting gang consisted of 1 foreman and 14 laborers at an average wage of 21 cents per man per hour; a 10-hour day was worked.

General Data.—The construction work was started in January, 1907, and all parts were cast and ready for erection in May. The severe winter made it necessary to expend a good deal of money in covering the concrete with manure, straw, etc., and in putting steam pipes around the members to thaw out the joint between member and slab on which it was cast. It was found necessary to build a low shed and heat it with steam in order to cast the roof slabs and avoid freezing. Two or three columns froze in spite of the precautions taken; these showed evidences of it when they were lifted for erection and consequently were discarded. Much of the work was done while thermometer was near the zero mark. The following is the total cost of the building as described:

Labor—		
Excavating, making and setting forms, making concrete and casting	$6,612.82	
Erecting and moving girders, columns, slabs, &c.	4,597.23	
Piping, steam heating, and machine shop work	343.23	
Electrical	17.89	
Railroad maintenance	36.57	
		$11,607.74
Material—		
Cement at $1 per bbl.	$1,453.20	
Crushed stone at $0.60 per ton	956.55	
Steel for reinforcing	2,867.13	
Lumber	464.95	
Rigger's supplies (extra for this job)	151.59	
Sundry supplies from store room	733.56	
Freight	244.14	
Piping, valves, etc.	132.68	
Sheathing paper (for separating members)	40.70	
		$7,044.50
Total cost of building without floors, head houses, structural work and corrugated inclosure		$18,652.24
Additional cost for floors, stands, structural iron, and corrugated iron sheathing	$4,455.15	
		$4,455.15
Total cost of building...		$23,107.39

A steel kiln house of exactly the same size erected in 1906 presents the following comparison of cost:

Steel building complete	$13,422.66
Concrete building complete	11,553.69
Balance in favor of concrete	$1,868.97

A "Gravity Shovel" in a Concrete Mixer.

The accompanying illustration shows three positions of the rotating drum of the McKelvey mixer. There are two "gravity shovels" pivoted to the inside of the mixer. The shovel starts filled at the bottom, and, as it rises, the material begins to slide off. After about a quarter of a revolution, the shovel rotates suddenly and casts the mass toward the center of the mixer. It is claimed that, in addition to securing a perfect mixing, this device saves power, for the material is not lifted to an unnecessary height before it is cast back upon itself. The object in reducing the amount of power used is not merely to effect a saving in fuel, but to enable a smaller and less expensive engine to do a great amount of useful work.

A lever on the outside of the drum of the mixer serves to control these gravity shovels so that they cast the material into the discharge chute when it is desired to discharge the batch of concrete.

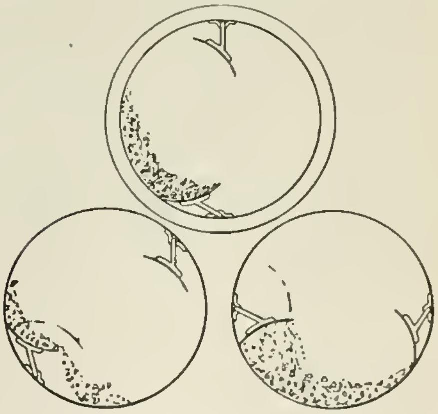


Diagram Showing Successive Positions of "Gravity Shovel" in McKelvey Mixer.

The McKelvey Concrete Machinery Co., 220 Broadway, New York, are the patentees of this "gravity shovel," which they use on their continuous mixers as well as on their batch mixers, whether operated by hand, horse or steam power.

The Production and Consumption of Hydraulic Cement in the United States in 1906.

The production of hydraulic cement in the United States during the calendar year 1906 was some eleven million barrels larger than during any previous year in the history of the industry and the consumption was greater than the production by some two million barrels. The exact figures as given by the report of the U. S. Geological Survey just published are as follows:

Kind.	Barrels.	Value.
Portland	46,463,424	$52,466,186
Natural	4,055,797	2,423,170
Puzzolan	481,224	412,921
Total	51,000,445	$55,302,277

The distribution of production of Portland cement was as follows:

	1906		
Section.	Number of works.	Quantity. (barrels).	Percentage.
New York	9	2,414,362	5.2
Lehigh and Northampton counties, Pa.	17	18,360,965	39.5
New Jersey	3	4,423,648	9.5
Ohio	8	1,422,901	3.1
Michigan	14	3,747,525	8.1
All other sections	33	16,094,023	34.6
Total	84	46,463,424	100.00

As will be seen the "Lehigh district" of Pennsylvania and New Jersey are credited with nearly half of the total production. The report states that "the prices at which cement was sold in 1906 were higher than those which prevailed in 1905. They were not inflated, however, but were on a healthy normal basis. The producers made no complaint of prices, but from nearly every state in the union protests were made as to the grave difficulty of obtaining sufficient car service for the delivery of orders."

The following table shows the apparent total consumption in the United States of all hydraulic cements in 1906:

	Barrels.
Total production	51,000,445
Imports withdrawn for consumption	2,274,677
Total	53,275,122
Exports	583,299
Total consumption	52,691,823

The statistical inquiry card for 1906 contained a number of questions relating to technologic matters which have heretofore been neglected. The questions relative to number and length of kilns were answered by practically all the cement producers of the country.

Omitting vertical or stationary kilns, these figures may be summarized as follows:

	1906.
Operated	793
Idle	2
Building	104
Total number of rotary kilns	899

The kilns listed as "operated" were those actually in operation during part or all of 1906; the "idle" kilns were those at mills which were not in operation at any time during the year, but which are still in good condition; the "building" kilns include only those which are in plants actually under construction and sufficiently far advanced to be able to enter the 1907 production. In 1902 each active rotary kiln averaged 36,909 barrels during the year; in 1905 this average was increased to 48,118 barrels; in 1906 the average output per active rotary rose to 58,901 barrels. It is probable that the annual average per kiln for 1907 will exceed 60,000 barrels, and with the increased number of kilns then in operation the Portland cement output of 1907 may reach 55,000,000 barrels.

The data obtained as to the length of kiln in both operating and new plants are summarized in the following table. As will be seen by comparison of the totals in this table with those of the preceding table, the statistics as to length are almost complete:

Length of kiln, ft.	No. kilns operated.	No. kilns under con.
60 and less	398	..
70 to 78	40	..
80	69	..
85 to 90	66	..
95 to 100	52	22
105 to 110	80	24
120	17	16
125 and longer	57	30
Total	779	92

This table brings out very sharply the rapidity with which kilns are lengthening, and also the diversity of opinion which still exists as to the relative merits of the various lengths above 100 ft.

The statistical data received from each plant this year included information as to total output, number and length of kilns, and duration of total shut downs. By means of these data, which cover a very wide range of material, practice, and operating conditions, it seems probable that average results of fair accuracy can be deduced as to the effect of raw material and length of kiln on the output. This has, at any rate, been attempted, and the results are presented in the following table. In explanation of this table it may be said that the average annual output of a 60-ft. kiln, fired with powdered coal and working on a dry mixture of limestone and clay, is taken at 100 per cent. The average outputs of similar and longer kilns working on various raw materials is then referred to this standard, the results being expressed in percentage:

	Length of kiln.			
Raw materials.	60 feet.	80 feet.	90 feet.	100 feet.
Cement rock and limestone	126	164	182	216
Limestone and clay	100	150	166	190
Marl and clay	54	76	...	...

These averages plot into a fairly smooth curve, and seem worthy of attention. Unfortunately the results obtained from kilns fired with oil, natural gas, and producer gas were too few and too uneven to be considered in this connection, so that the table refers only to coal-fired kilns. The results in running on a slag-limestone mixture are omitted for obvious reasons, but they fully justify everything that has been said regarding the remarkable kiln efficiency which can be attained in a plant using this mixture.

Delivering Concrete 200 ft. Through a Trough.

There is nothing new about delivering very wet concrete by means of a trough, where the slope of the trough is quite steep and the distance is short. One contractor, however, has modified this plan in a simple and ingenious manner, so that he is able to convey concrete from his mixer for a distance of 200 ft. in a trough having a slope of less than 10 ft. in a hundred. To do so, he stations laborers with shovels, which they use like paddles, in keeping the wet concrete moving forward through the trough. By stationing these men about 10 ft. apart, he is able to deliver 100 cu. yds. of concrete per day from the mixer. With wages at $1.50 per day, the cost would, therefore, be 1½ cent per cu. yd. for every 10 ft. that concrete is conveyed.

The trough used for this purpose was a V-shaped affair, made of 1x12-in. boards, in sections 16 ft. long.

The concrete was mixed in a Eureka continuous mixer. The gravel was dumped near the mixer, and a team hitched to a drag scraper delivered the gravel alongside the mixer. Four men shoveled it into the mixer, but only two men worked at a time, shoveling for a period of 15 minutes, and then resting for a corresponding period while the other two worked. In this manner the four men shoveled enough gravel to make 100 cu. yds. of concrete per day. A fifth man opened the cement bags and kept the cement hopper full.

For the foregoing information we are indebted to Mr. Frederick W. Fisher, Engineer and Manager of the Eureka Machine Co., Lansing, Mich.

Short term tenders will be received by the First Lord of the Admiralty, London, England, for the construction of a new lock at Portsmouth, England, to cost about $5,000,000.

A water power development of some magnitude is now being constructed in Norway, according to a recent consular report. According to this report a tunnel is being constructed which will bring the water from the great Ringedalsvand of Norway (into which the Skjaeggedalsfos falls) down to the fiord. The project includes the following features: First, from that lake there is a tunnel 300 meters long to another small one, known as the Lillevand. From this point there is a tunnel 4,600 meters in length, 3 meters wide and 2½ meters high, to the face of the rock facing the Sorfjord. From this tunnel the water will be conveyed in pipes down the 400 meters decline to the fiord. Down at the sea level and close to the wall of rock is the power station, from which the electric power will be conducted along the 7-kilometer stretch to a factory at Odda.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Specification on Earth Classification.

The following clause is copied from specifications governing the graduation work on a railroad:

"Earth shall include loam, clay, sand, gravel, chert, cemented sand, indurated clay, joint clay, pipe clay, decomposed rock and slate, and all other material of an earthy kind. Earth shall also include loose stone or boulders, which do not exceed 2 cu. ft. in size, enclosed in masses of earth, wherein the proportion of boulders or loose stone is one-half or less.

"Loose rock shall include shale, slate, coal ———; and masses of earth mixed with loose stone and boulders of 2 cu. ft. or more average size, wherein the proportion of rock to the whole mass is more than one-half."

Except in one provision, the first part of the clause defining earth excavation is somewhat similar to nearly all such clauses in railroad specifications. They usually are drawn so as to include in the earth class all materials that are not listed under the loose and solid rock classes. The exception here is chert. The materials listed include many that are easily excavated and also some that are difficult and expensive to excavate, but of all of these chert is certainly the hardest, and with the exception of heavy clays saturated with water, in all probability the most expensive to dig.

To classify chert as earth seems exceedingly unreasonable, for it is in realty a rock. A definition of chert is as follows: "Chert is an impure flint or hornstone occurring in beds in some of the stratified carbonate rocks, especially limestone."

Chert is a rock and should be classified as such. When chert is surrounded by earth, it is expensive to excavate, unless in layers of only a few inches thickness, when it can be plowed. Thick beds of it cannot be plowed, but must be blasted by making numerous small blasts, and even after chert is broken up it quickly wears out the bits and pans of scrapers.

The last sentence in each of the above clauses is rather unusual. Boulders that do not exceed 2 cu. ft. in size and are not one-half the mass, are earth. Boulders of 2 cu. ft. or more, where they exceed one-half the mass are loose rock. How about boulders that do not exceed 2 cu. ft. in size and are more than one-half the mass, or boulders that are more than 2 cu. ft. that are less than one-half the mass? No classification is provided for these two, and these two conditions are found quite frequently in some sections of the country, whereas the conditions named in the specifications are rarely found.

Should the contractors claim loose rock because more than 50 per cent is boulders, the engineer can deny his claim on the ground that the average size of the boulders is less than 2 cu. ft. On the other hand, if the contractor call attention to the size of the boulders in a cut, the engineer can answer that only earth can be allowed as the boulders are less than 50 per cent of the mass.

These specification clauses are not only unusual, but very indefinite. Perhaps the engineer who drew them up knew what his ruling would be, and perhaps a contractor who knew the engineer might feel that any ruling would be a fair one, but what protection has such a contractor in case some other engineer takes charge of the work?

A Daily Report Card for Rock Drillers.

Few rock drillers get as much work out of their machines as is possible. Indeed, most drills are capable of doing 50 per cent more work in a day if well handled than they do with the ordinary handling. We illustrate herewith a daily report card, devised by one of the editors of this journal. Every morning, each driller is supplied with one of these cards, on the back of which is written the driller's name and letter (a letter being assigned to each driller) and the day of the month. Each driller is supplied with a conductor's punch. When his drill is set up, and ready to begin drilling, he punches the hour and nearest even minute. In this case, drilling began at 7 a. m. on a hole that had been started the previous day, but not finished. At 7:30 he finished the hole, having drilled 6 ft. in the 30 minutes, consequently, under "6" and opposite "Finish," he punches a hole in the card to show the work done in finishing the hole begun the day before.

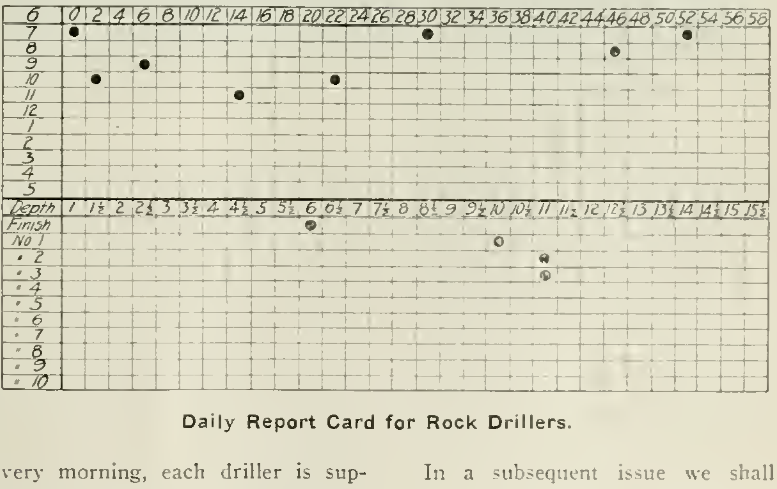
When the drill has been shifted and set up again, ready to begin hammering on hole No. 1, the driller punches the hour and nearest even minute, which in this case is 7:52. This shows that he took 22 minutes to shift the drill. The next punch mark shows that he finished hole No. 1 at 8:46. Opposite No. 1, the punch mark indicates that this hole was 10 ft. deep.

Hole No. 2 was begun at 9:06 and finished at 10:02 and was 11 ft. deep, as shown by the punch marks.

In this manner a log of the day's work is kept by each driller. The driller, whose hands are usually greasy and grimy, does not have to use a pencil to record his work, and takes kindly to a card upon which the records are made with a conductor's punch.

As soon as each hole is drilled, a plug should be driven into the hole and the plug should be branded with a letter and the number of the hole, as A2. Each driller is assigned a different letter, and is provided with a set of branded plugs. The timekeeper or the foreman, can then make a chart each day showing the location of every hole and its depth.

At the end of each week it is well to bulletin the work of the drillers, and award a prize to the man with the best record. In conjunction with this, a bonus should be given to every man who has drilled more than a specified minimum number of feet. The results are astonishing, when compared with records of work made before the adoption of the bonus system.



Daily Report Card for Rock Drillers.

In a subsequent issue we shall show how to chart the drill holes, and keep a record of the explosive used.

Plans are being prepared by the Ottoman Government for the construction of a railroad from Haifa to Jerusalem, also of a protected harbor at Haifa which is intended to be several times larger than the harbor at Beirut.

Cost of an Aerial Cable Bridge Used in Making a Deep Fill with Dump Cars.

BY J. D. MOONEY.*

In making a single-track, 175,000 cu. yd. fill, the Williams Bros. & Morse Co. of Cleveland, Ohio, saved $1,700 by using an aerial cable bridge in preference to a timber trestle. The fill was 400 ft. long and 95 ft. deep. It was located between Stations 377 and 381 on the Lake Erie & Pittsburg Ry., now under construction from Cleveland to Pittsburg. An accurate account of all expenditures made on the cable bridge for material and labor was kept, and a careful estimate was made by Mr. A. E. Williams of the Williams Bros. & Morse Co. on the least probable cost of a trestle which would have met the same conditions as were presented to the cable bridge.

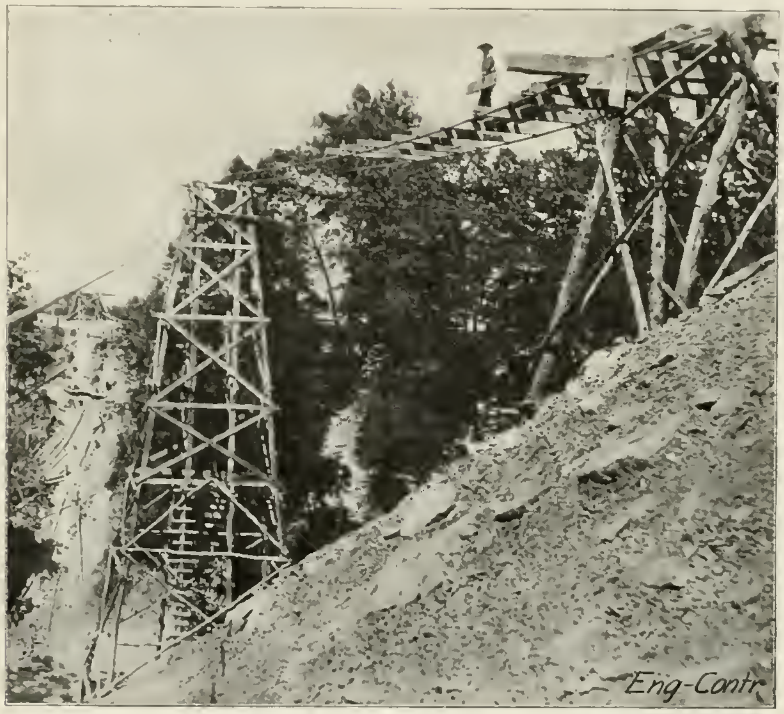


Fig. 1. View of Cable Bridge for Making Deep Fill With Dump Cars.

Frequent accidents on cable bridges have rather shaken the confidence of contractors in this means of providing a bridge for dump cars, but it seems that these mishaps have been due to improper construction and the use of cables that were not large enough to stand the heavy strains. In this case the cableway has withstood the loads that have been put upon it, as the anchors and wooden supports were made extra heavy, and a 2¼-in. Roebling galvanized bridge cable was used.

The anchors were 400 ft. apart, and an A-frame, Fig. 1, was erected to support the cable in the middle; this made the span 200 ft. The anchor at the north bank consists of a log, 18 ft. long, 24 ins. thick, imbedded in solid rock. Two eyebolts screw into the log and are fastened by heavy nuts over 8-in. cast iron washers. Connecting with these eyebolts are two 10-ft. chains with 10-in. links made from 2½-in. iron. These chains were put in to keep the cables from twisting by covering the chains with heavy weights. Two 3-in. turnbuckles, with a spread of 3 ft., made the connections between the chains and the cables. The cables were leaded into the turnbuckles. These turnbuckles, which were forged especially for this work, were used to take up the slack in the cables. The anchor at the south end consisted of a log, 25 ft. long and 24 ins. thick, placed in a new fill of sandstone, 10 ft. deep. Three inch planks were driven in front of the anchor, two eyebolts, 22 ins. long and 2½ ins. in diameter, were screwed into the anchor log and fastened with nuts over cast washers, 8 ins. in diameter and 2 ins. thick. The eyebolts connected with clevises by means of 3-in. pins. The cables were leaded into these clevises. A rise of 1 ft. in 3 ft. brings the cables up to grade and to the end timber supports, as shown by Fig. 2.

The fill is being made from the south end of the cableway and bents are put in as the work advances to help support the weight of the cars. The support for the cables on the north bank is made of 10-in. logs resting on mud-sills. There are two 6-in. hickory rollers on which the cables rest to allow them to accommodate themselves to different lengths.

The A-frame which supports the cables in the center is made of two bents of four timbers each. The lower 50 ft. of the frame is made of 10-in. round timbers and the upper 42 ft. of 8x8-in square timbers. The cables on the top of the A-frame are 8 ft. above grade. The bents rest on 10-in. mud sills. They have a batter of 1½ ins. to a foot. The frame is 32x26 ft. at the bottom.

A train consists of from six to twelve 4 cu. yd. cars. These are emptied at the south end of the ravine and are pushed out onto the cableway as fast as they are emptied. The car rails are spiked to ties which rest on stringers. These stringers rest on 8-ft. logs fastened to the cables with U bolts. The cables are 7 ft. apart. Most of the fill is being made from a sandstone cut about a half mile distant. This sandstone has a slope a little steeper than 1½ to 1.

The following is the actual cost of the aerial cableway:

1,000 ft. 2¼-in. Roebling galvanized bridge cable	$ 600.00
Eyebolts, 2½-in., with clevises, for both ends	108.30
2 turnbuckles at north end, 3-in.	120.00
2 chains at north end, 10 ft. long, 2½-in. iron	62.40
4 cast washers, 8 ins. dia., 2 ins. thick	2.46
Timber for A frame. (All other timber was obtained on ground.)	
Upper 42 ft., 14-ft. timber, 8x8 ins. All bracing and cross ties. 3,200 ft. at $34 per M (delivered)	108.80
Lower 50 ft., round timber, 56 ft. long, bought in tree	32.00
Cost of team work for hauling round timber and pulling timber to place for erecting	65.00
Carpenter labor on A frame and end bents on bank	231.40
Time of superintendent, getting material and overseeing work in general	60.00
Common labor:	
Digging trenches for anchors and putting up cableway	112.00
Nails and iron in A frame and bents	29.40
Total cost of cableway	$1,531.76

A conservative estimate made by Mr. A. E. Williams of the Williams Bros. & Morse Co. on the probable cost of a timber trestle for this opening, figuring on square 8x8-in. timber cut from native timber, gives the following cost:

98,000 ft. B. M. (including all uprights, planks for bracing, stringers, etc.) at $26	$2,548.00
Labor for putting up trestle, $6 per M. ft.	588.00
Spikes	98.00
Iron drift bolts	40.00
Total cost of trestle	$3,274.00

Saving effected by using cableway:

Estimated minimum cost of trestle	$3,274.00
Actual cost of cableway	1,531.76
Difference in favor of cableway	$1,742.24

The Formosan Government has recently created an irrigation section under the bureau of public works and an engineer for the section is at present in the United States studying the work of the U. S. Reclamation Service. According to preliminary reports about $15,000,000 is to be expended in irrigation work in Formosa.

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*Cleveland, Ohio

The Cost of Hand Drilling and Sharpening Steel, and Burning Charcoal.

The following cost of drilling gneiss rock relates to work done under one of the editors of this paper in the south a few years ago. The rock excavation was made in building a new railroad in a mountainous section. The rock was hard but not very seamy. Three men worked in a gang; two driving steel and the third holding, nine pound striking hammers being used. Eight of these gangs worked on the job, and some little rivalry existed as to the depth of hole driven in ten hours. The average work done by these gangs was as follows:

2 gangs drove 12 ft. per day = 24 ft.
4 gangs drove 14 ft. per day = 56 ft.
1 gang drove 16 ft. per day = 16 ft.
1 gang drove 17 ft. per day = 17 ft.

Total ....113 ft.

The wages for 10 hours were:

Drillers	$1.50
Nippers (stout boy)	1.00
Blacksmith	2.50
Blacksmith helper	1.50
Charcoal burner	1.50

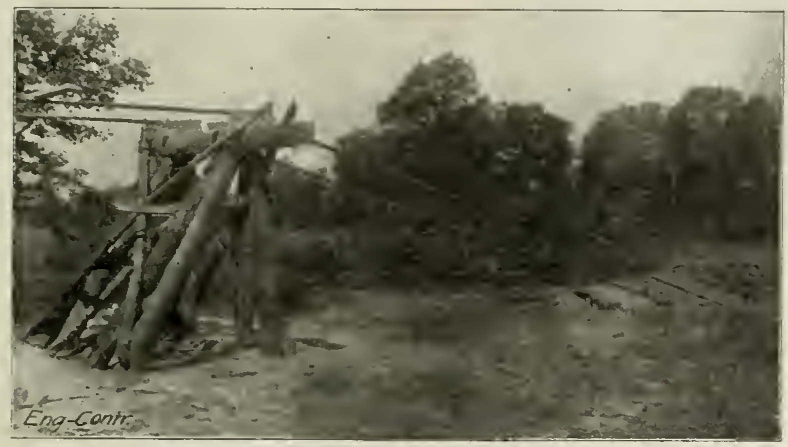

Fig. 2. Anchorage and Pier Support for Cables of Cable Bridge.

The total cost for drilling per day was as follows:

24 drillers	$36.00
4 nippers	4.00
Blacksmith	2.50
Helper	1.50
Charcoal burner	1.50
Borax and salt	.10
Total	$45.60

The cost per lineal foot in detail was:

Drilling	$0.318
Nipping	0.035
Blacksmithing	0.050
Total	$0.403

One nipper carried steel to and from the blacksmith shop for two drilling gangs, the distance being less than a half mile.

The nippers also carried water for the drillers, the work of the latter being only to drive the steel and clean the sludge from the holes.

The starters or jumpers had a bit of 2 ins., and the holes, which were from 6 to 16 ft. deep, were finished off with bits from 1½ in. to 1¼ in. The steel used for drills was 1⅛ in. octagonal.

Most of the excavation was side hill work, and holes were spaced at various distances to suit the conditions for each blast; hence definite idea as to the cost of drilling per cubic yard cannot be given. The record here given is for holes 6 ft. or more in depth. With shallow holes, such as are needed for "blocking," fewer feet per day were driven, as time was lost by the drilling crew moving from place to place, and also in starting a larger number of holes.

Owing to the fact that the price of coal was high and the hauling from the railroad cost from 50 to 60 cts a 100 lbs., the contractor used charcoal in sharpening his steel. One man was detailed to make the charcoal, and was employed continuously. He got the wood from the right of way, and, as he used up the wood at one place, moved his charcoal pits along the road bed.

He dug a pit, in which to do his burning, and cut up his wood in cord wood lengths. After getting his fire fairly hot he covered it over with stones and earth, which allowed the fire to burn slowly without dying out. In this way the wood was not consumed, but was burnt into a fair quality of charcoal. After it had turned into charcoal he uncovered it, and put the charcoal into sacks, carrying it to a shed adjoining the blacksmith shop. He did all the work himself and managed to keep enough charcoal on hand, even in bad weather, to run the shop. At first he used only hard woods, such as oak, hickory, ash, etc., but it was evident that the supply would give out, so he mixed with it from ¼ to ⅓ soft wood, hemlock and pine. This did not make as good a quality of charcoal, but it answered the purpose for which it was intended.

The blacksmith was a man who had been accustomed to sharpening drills for iron mining and had used charcoal before. The forge was built up of stone, with a duck's nest in it, and a 5-leaf bellows to furnish the draft. With charcoal the helper was needed to pump the bellows continuously when heating steel.

The smith used the borax in which to dip his drill points before beginning hammering, and also for welding, when it was necessary. He put salt into his cooling tub, being careful to proportion so many pounds to so many gallons of water. The writer does not know that this was any help, but the smith believed it was, and unless he was allowed to have these small items to suit him, he had a good excuse to offer if his work was not satisfactory.

Methods and Cost of Moving Earth in the Fresno Scrapers in Arizona, and the Cost of Trimming Slopes.

Fresno or buck scrapers have not been much used in the eastern part of the United States by contractors. The Fresno being a tool invented in California, its use has, to a great extent, been confined to the southwestern section of the country. It is adapted to various kinds of earth excavation, and, when it can be used, it will move more dirt per day than any other style of scraper, especially on short hauls.

The following example of Fresno scraper work, done in Arizona in 1894, under one of the editors of this journal, may prove of interest. The scrapers were used in grading a railroad bed, the cuts being 10 ft. wide and the embankments 8 ft. wide. The road was narrow gage. Thirteen miles of roadbed were graded, the yardage moved being 70,000, or 5,400 cu. yds. per mile.

The contractor managed his own work, having only foremen in charge of the various gangs directly under him. One man kept the time books, attended to the commissary and also acted as bookkeeper. In this way the general expense account was a small one. The wages paid were as follows:

Time keeper, $50 per month and board.
Foreman, $3 per 10-hour day.
Foreman, $2.50 per 10-hour day
Drivers, $1.70 per 10-hour day.
Laborers, $1.75 per 10-hour day.

The men were charged 75 cents per day for board. The horse feed was hauled by the contractor's teams from his own ranch, and he estimated that the entire cost of feeding and caring for a horse per day averaged 75 cents. This makes a charge for teams as follows:

4-horse Fresno scraper, team and driver	$4.75
2-horse drag scraper, team and driver	3.25
4-horse plow, team and two men	7.00
6-horse plow, team and two men	8.50

The charge for the plows include an alowance of 50 cents per day for the use of plows and repairs.

The earth excavated was virgin soil, and it was very difficult for a six-horse plow to break the first foot, but, after reaching that depth, a four horse plow did the plowing easily. The work consisted of shallow cuts, not over 5 ft. deep; but one cut, about 1,000 ft. long, was 15 ft. deep. More than half the roadbed was embankment, ranging from 5 ft. filling to 20 ft., the average being from 8 to 10 ft. high. The contractor hauled the material from the cuts into the embankments when the lead did not exceed 200 ft.; beyond that distance he wasted the material from the cuts and borrowed for the embankment at his own expense. He considered this cheaper than to haul it. No record was kept of this extra yardage, as he was paid for the cross section quantities, as though he had made the hauls. Fig. 1 shows the manner of making an embankment 10 ft. high.

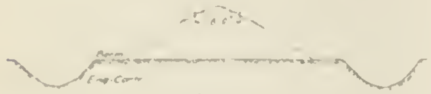

Fig. 1.

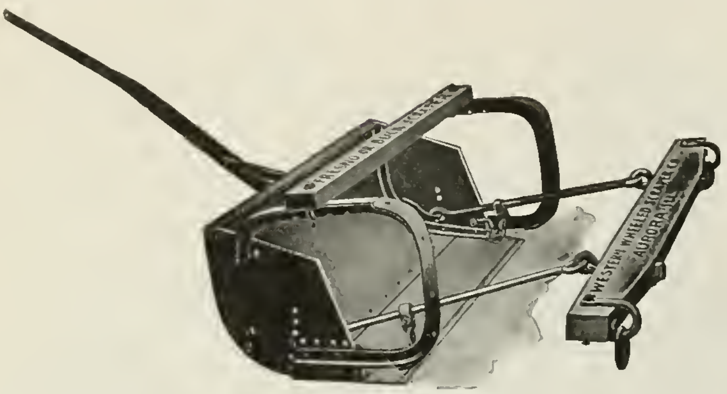

Fig. 2. The Fresno Scraper.

The ditches are plowed on each side of the embankment leaving a turn between the ditch and the toe of the slope. The scraper is loaded in one ditch and pulls onto the embankment keeping straight ahead, crossing the ditch on the other side and turning. Then starting back and taking another load the operation is repeated. For an embankment 10 ft. high, this gives a "lead" of about 40 ft., and a distance to be traveled for each load of 100 ft. The amount of earth pushed ahead in such a short distance is very large, but the haul is always uphill for the load. Each team has its own men, the scrapers not being operated in gangs as with wheelers and drags, but in separate runs side by side, and, by so doing, a certain pace can be set and maintained, as the foreman can see at a glance when all the scrapers are not being loaded at one time. The driver loads and dumps his own scraper, which effects a decided saving in loading and dumping, as compared with wheeled scrapers.

A rope on the end of the lever, see Fig. 2, makes this operation easy, the scraper being balanced on the two arch springs in front, dumps as soon as the lever is lifted. It rides in this position to the pit, and then a jerk on the rope throws the pan back on its bottom ready for loading. The driver handles his four horses as follows: The two outside horses have a "jockey stick" tied to their bits, and each horse's bridle is fastened to the adjoining horse's bridle by a short strap or rawhide string. The two reins are each divided into two lines, one line going to each horse's bridle, the lines from one rein going to one outside horse, and to the second outside horse from it. Thus the left hand rein pulls the left hand outside horse and the right hand inside horse, those two guiding the other two by the bit straps. The right hand rein controls the other two horses.

No attempt was made to shape the embankment to the dotted lines as shown in Fig. 1, but the scrapers heaped up the dirt as shown by the heavy lines, and left it so, until the dressing up gang finished off the roadbed. On the highest embankments the Fresno scrapers could not be worked in topping off the embankments to good advantage, owing to the climb necessary to be made from the bottom of the ditch to the top of the bank, so drag scrapers were used for this work. Since no record was kept of this drag scraper work, it will have to be included with the work done by the Fresno scrapers.

The cost of the work was:

	Per cu.yd.
General expense	$.003
Plowing	.020
Scrapers	.050
Dressing roadbed	.005
Total cost	$.078

At 5 cts. per cu. yd. this means 95 cu. yds. moved per scraper per day. If allowance is made for foreman, which is included in the cost of 5 cts., this yardage would be increased to about 105. This amount would be further increased if the drag scraper work could have been separated, and if the additional yardage wasted from the cuts had been measured.

It must be remembered that some time is lost, by the fact that plowing cannot go on as the scrapers are working, when the latter are handled in the manner described. Hence, when a "plowing" is cleaned up, the scrapers must be moved to another section that has been freshly plowed.

In Gillette's "Earthwork and Its Cost," page 49, some costs are given of Fresno scraper work done in California. Records of moving from 90 to 130 cu. yds. per day are shown, which agree somewhat with the work being described.

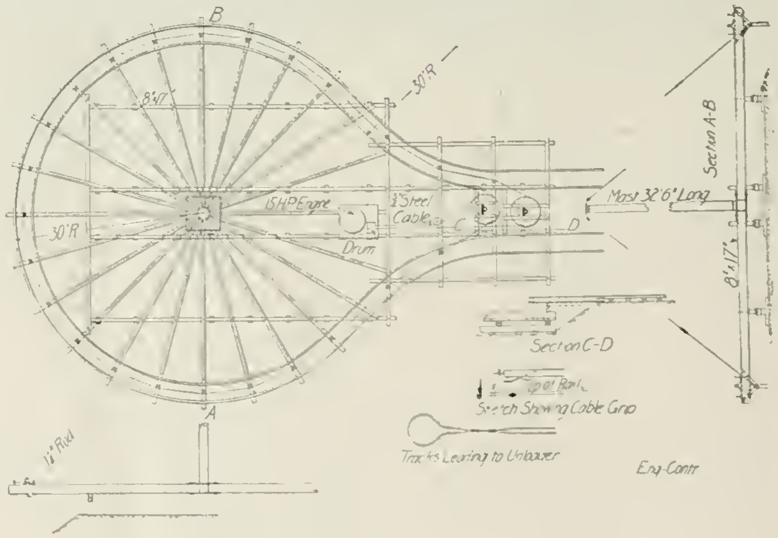

Fig. 1. Plan of Continuous Car Unloader for Making Fills.

A point of interest was the method of dressing up this work. Only one man with a pick and shovel was used on the job. He did the work necessary on the slopes, although by careful plowing these were brought down in good shape as the cuts were excavated. He also shaped up the roadbed in the cuts when the scrapers left small places that it did not pay to hold teams to do. All the rest of the dressing work was done by a foreman and three drag scrapers. They took out any excess material left in the cuts and smoothed over the bottom whenever possible. They leveled the embankments down to the proper grade, and, if more material was needed on the bank, they brought it up from the side ditches, see Fig. 1.

A man with some little instruction can become very expert in dressing a roadbed with a scraper in this manner. He holds the drag scraper at various angles, cutting off high places and filling up low places as desired. This work cost ½ ct. per cu. yd. of material moved and not quite a ½ ct. per sq. yd. of roadbed. About ⅛ of this cost was for the man using a pick and shovel and not quite 1/6 was for the foreman who manipulated the scraper.

This cost of trimming is quite low. It will compare very favorably with trimming done by a road machine and other leveling apparatus. As compared with trimming done by hand on railroads, it is from 1/3 to ½ cheaper than records of this work done by one of the editors of this journal.

Contractors in the east and middle west would do well to consider the use of such a dirt moving tool as the Fresno scraper. It can be used in almost any place adapted for a drag, and does work at much less cost.

The Classification of Slate Rock.

In looking over a number of specifications for railroad grading, we notice that slate is listed in many cases with other materials that are to be classified as loose rock. In most cases solid rock is specified in another clause "as rock that occurs in ledges or masses, having a volume of one cubic yard or more that can only be removed by blasting."

According to this clause slate should be classed as solid rock; yet, inasmuch as it is specifically listed under loose rock, courts have decided it must be paid for as loose rock.

Slate frequently occurs in thick and heavy ledges, that are difficult to drill, owing to its close grain; and the blasting and mucking are as expensive as in sand stone or limestone. One of the editors of this paper has excavated thousands of yards of such slate, yet the specifications under which he has worked called for a classification of this material as loose rock. In Gillette's "Rock Excavation—Methods and Cost," page 229, examples of slate excavation are given showing that the cost equaled hard gray sandstone.

There may be a few cases where the cost of excavating slate is about the same as loose rock, but as a rule it is much more expensive. In consideration of these facts, slate should not be listed as loose rock.

The Chilean Government has granted a concession to the German Transatlantic Electric Co. to erect a hydraulic electric power and lighting plant on the River Maipo, above Santiago, to cost about $4,015,000 U. S. gold.

A Continuous Car Unloader.

In making high embankments on railroads with dump cars operated in trains it is generally necessary to build temporary trestles. As these trestles are filled in, only the ties and stringers can be recovered, and the cost of each trestle is thus chargeable to a particular embankment. If the embankment is either very small or very large the cost per cubic yard of embankment is larger than when embankments are of fair size only. Using round timbers that can be gotten from local timber lands, this cost is generally about 3 cts. per cubic yard.

Many sections of our country are without any available local timber, and in those parts of the country the cost would be much higher. In order to effect a saving in this line, Mr. F. F. Lloyd, of California, has invented and patented a car unloader, which we illustrate in the accompanying cuts.

Fig. 1 shows a plan of the arrangement which rests on the end of the embankment as it is being made. Fig. 2 gives a good idea of the general appearance of the whole device. A 15 H. P. hoisting engine pulls the cars around the circle as shown on the plan, and the engine also moves the machine ahead, when it is necessary, on the rollers beneath the framework by means of the gipsey.

The advantages claimed for this unloader are that it is: Simple in construction; easy to operate; lower first cost, and the fact that it can be readily moved from one piece of work to another. Fills can also be made across marshy land or water.

Mr. Lloyd writes us that no inconvenience has been experienced in handling material that slips or slides on a fill 114 ft. high. He suggests that the machine be not used on embankments less than 35 ft. in height. He states that it is difficult to say how many cars it will handle in a day, as the cars unload while in motion, a train of eight cars discharging its load in a minute, thus handling cars faster than they can be brought to the dump.

In moving the machine forward, the distance of 10 ft. covered each move is made in 1½ hrs., and as these moves are made at noon or at the close of the day's work, trains are not out of service more than one-half hour from this cause. The unloader shown in the halftone has been in use since April 22, 1907, and has not delayed a single train except in moving forward.

In two days the machine can be knocked down and moved, and in three to four days it can again be assembled. Eight men operate the unloader. The cost of the machine including the hoisting engine is about $5,500. These machines have been used by E. B. and A. L. Stone Co., Contractors, Oakland, Cal.

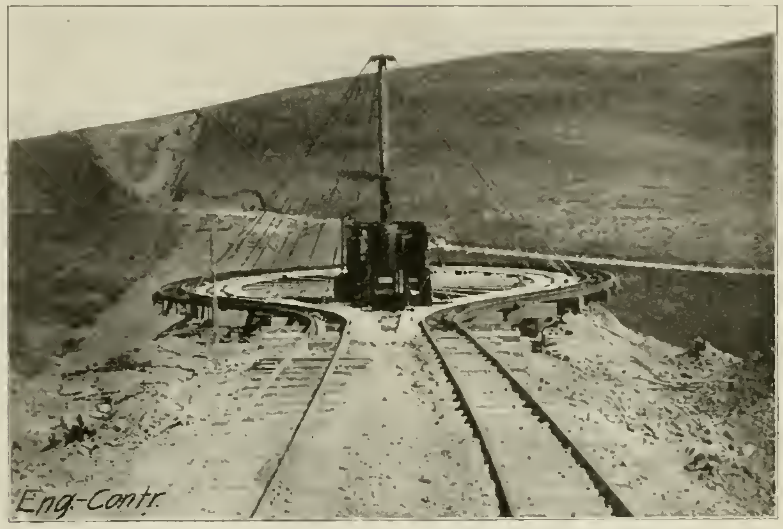

Fig. 2. General View of Continuous Car Unloader.

Cost of Hand Drilling on Manhattan Island.

In drilling for a small rock cut on Manhattan Island, New York, the work was done by hand. Two strikers and a holder averaged 15 ft. per 10 hour day. Each hole was 7½ ft. deep, the starting bit being 1⅞ ins. and the finishing bit 1¼ ins. The rock was a tough mica-schist. Each man averaged 5 ft. of hole per day, which is equivalent to 40 cts. per lin. ft. when wages are $2 a day. The holes were spaced very close together, averaging only 2½ ft. apart. Hence it required 4.3 lin. ft. of drill hole per cu. yd. excavated, which, at 40 cts. per lin. ft., made the cost $1.72 per cubic yard for drilling alone. The job was being done on a percentage basis, which may account, in part, for the fact that the contractor permitted such close spacing of the drill holes. As a matter of fact, small as the job was, it would have paid handsomely to have installed a steam drilling plant.

The cost given does not include the cost of sharpening the steel or carrying it to and from the blacksmith shop.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Tables Giving the Net Sections of Angles.

By T. Kennard Thomson.*

When doing some work for the Dominion Bridge Company some 13 years ago, I noticed they had some very useful tables giving the net section of angles figured out for the foreign shapes used there. On returning to my own office I got out similar tables for our American shapes, which I have found so very useful in my own practice that I think they ought to be published. The first column gives the size of the angles, the thickness of which, from ⅜ to ⅞ in. is given at the top. The next column gives the gross section of two angles. Then in the third column under 2, we have the net section of two angles with two rivet holes deducted. Under 3 we have the net section of two angles with 3 rivet holes deducted and under 4 the net section of two angles with 4 rivet holes. The tables are for ½, ⅝, ¾ and ⅞ in. rivets.

½-in Rivets, Holes ⅛-in. Larger.

Size, ins.	¼ ins.				5/16 ins.				⅜ ins.				7/16 ins.							
	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4				
2½" x 2½"	2.12	1 8	1.6	1 5	2 62	2 2	2.0	1 8	3.1	2 6	2 4	2 2	3 56	3.0	2.7	2 5	....	....	....	....
2½" x 1½"	1 66	1.3	1 2	1 0	2 14	1.8	1.6	1 4	2 54	2 1	1 8	1 6	2 90	2.3	2.1	1 8	....	....	....	....
2 " x 2 "	1 88	1.5	1 4	1 2	2.3	1.9	1 7	1 5	2 72	2 2	2 0	1.8	3 12	2.6	2.3	2.0	....	....	....	....
2 " x 1¾"	1.56	1 2	1 1	.9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
1¾" x 1¾"	1 62	1 3	1 2	1 0	2 0	1 6	1 4	1.2	2 34	1.9	1 6	1.4	2 5	2 6	2.1	1.5	....	....	....	....

⅝ in Rivets, Holes ⅛-in. Larger.

Size, ins.	¼ ins.				5/16 ins.				⅜ ins.				7/16 ins.				½ ins.			
	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4
3 " x 3 "	2 88	2 5	2 3	2 1	3.56	3.1	2.9	2 6	4 22	3.7	3 4	3.1	4 88	4 2	3 9	3.5	5 5	4.7	4 4	4 0
3 " x 2½"	2 62	2 3	2 1	1 9	3.24	2 8	2.5	2.3	3 84	3 3	3 0	2 7	4 44	3 8	3 5	3.1	5 0	4 2	3 9.	3 5
3 " x 2 "	2.38	2 0	1 8	1.6	2 94	2.5	2 2	2 0	3.46	2 9	2 6	2 3	4 0	3 3	3 0	2 7	4 5	3.7	3 4	3 0
2¾" x 2¾"	2 62	2 3	2 1	1.9	3·24	2 8	2.5	2 3	3 84	3 3	3 0	2 7	4 44	3 8	3 5	3 1	5 0	4 2	3 9	3 5
2½" x 2½"	2 38	2 0	1 8	1.6	2.94	2.5	2 2	2 0	3.46	2 9	2 6	2.3	4 0	3 3	3 0.	2.7	4 5	3.7	3.4	3 0
2½" x 2 "	2 12	1 8	1 6	1 4	2.62	2.2	1 9	1 7	3.1	2 5	2 3	2 0	3 56	2 9	2 6	2 2	4 0	3 2	2 8	2 5
2½" x 2¼"	2 12	1.8	1 6	1 4	2.62	2.2	1 9	1 7	3.1	2.5	2.3	2 0	3 56	2 9	2 6	2 2	4 0	3 2	2.8	2.5

¾-in. Rivets, Holes ⅛-in. Larger.

Size, ins.	⅜ ins.				7/16 ins.				½ ins.				9/16 ins.				⅝ ins.				11/16 ins.				¾ ins.				13/16 ins.				⅞ ins.			
	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4
6 "x6 "					10 12	9 2	8.8	8 4	11 5	10 5	10 0	9 5	12 86	11 7	11.2	10.6	14 22	13.	12.3	11 7	15 56	14 2	13 5	12 8	16 88	15 4	14 6	14 0	18 18	16 6	15 8	14 9	19 48	17 7	16.8	16 0
5 "x5 "	7 22	6 5	6 1	5 7	8 36	7 5	7 0	6.6	9 5	8 5	8 0	7 5	10 62	9 5	8 9	8 4	11.72	10 5	9.8	9 2	12 84	11 5	10 8	10 1	13.88	12 4	11 6	10.9	14 92	13 3	12 5	11 7	15.98	14 2	13.3	12 5
4 "x4 "	5 72	5.0	4 6	4 2	6 62	5 7	5 3	4 9	7.5	6 5	6 0	5 5	8 36	7 2	6 6	6 1	9 22	8 0	7.3	6 7	10 06	8 7	8 0	7 3	10 88	9 4	8 6	7 9	11 68	10 0	9 2	8 4	....	....	....	....
3½"x3½"	4 96	4 2	3 8	3 5	5 74	4 9	4 4	4 0	6 5	5 5	5.0	4 5	7 24	6 1	5 5	5	7.98	6 7	6.1	5 5	8 68	7 3	6 6	5 9	9 38	7 9	7 1	6.4	10 06	8 4	7 6	6 8	....	....	....	
3 "x3 "	4 22	3 5	3 1	2 7	4 88	4 0	3 6	3 1	5 5	4 5	4 0	3 5	6 12	5 0	4 4	3.9	6.72	5 5	4 9	4 2	....	....	....	....	....			....	....						....	
7 "x3½"					8 8	7 9	7.5	7 0	10 0	9 0	8.5	8 0	11.18	10 0	9.5	8.9	12.34	11 1	10.5	9 8	13 5	12 1	11.5	10 8	14 62	13.1	12.4	11 6	15 74	14 1	13 3	12 5	16.84	15 1	14 2	13.3
6 "x4 "	7 22	6 5	6.1	5.7	8 36	7 5	7 0	6.6	9 5	8 5	8.0	7 5	10 62	9 5	8.9	8.4	11 72	10 5	9.8	9 2	12 84	11 5	10 8	10 1	13 88	12 4	11.6	10.9	14 94	13 3	12 5	11 7	15.98	14 2	13.3	12 5
6 "x3½"	6 84	6 1	5 7	5 3	7 94	7 0	6 6	6 2	9 0	8 0	7 5	7 0	10 06	8 9	8.4	7 8	11 1	9 8	9 2	8 6	12.12	10.8	10 1	9.4	13 12	11 6	10 9	10.1	14.12	12.5	11 7	10 9	15.1	13.3	12 5	11 6
5 "x4 "	6 46	5 7	5.3	5 0	7 5	6 6	6.2	5 7	8 5	7.5	7.0	6 5	9.5	8 4	7.8	7 2	10 46	9 2	8 6	8 0	11 44	10.1	9 4	8.7	12.38	10.9	10.1	9.4	13.3	11.7	10 9	10 0	14 22	12.5	11 6	10 7
5 "x3½"	6 1	5 3	5 0	4 6	7 06	6.2	5.7	5 3	8 0	7 0	6.5	6 0	8.94	7 8	7.2	6.7	9 84	8.6	8 0	7 3	10.74	9.4	8.7	8.0	11.62	10.1	9.4	8.6	12.5	10.9	10 0	9.2	13.34	11.6	10.7	9.8
5 "x3 "	5 72	5 0	4 6	4 2	6 62	5 7	5 3	4 9	7 5	6 5	6.0	5 5	8.36	7 2	6.7	6.1	9 22	8.0	7.3	6 7	10.06	8.7	8 0	7.3	10.88	9.4	8.6	7.9	11.68	10.0	9 2	8.4	....	....	....	....
4½"x3 "	5.34	4 6	4 2	3 8	6.18	5 3	4 9	4 4	7 0	6 0	5.5	5 0	7.8	6.7	6.1	5.5	8.6	7 3	6 7	6 1	9 36	8 0	7.3	6.6	10.12	8.6	7.9	7.1	10.86	9 2	8 4	7.6	....	....		....
4 "x3½"	5 34	4 6	4 2	3 8	6.18	5.3	4 9	4 4	7 0	6 0	5.5	5 0	7 8	6.7	6.1	5.5	8 6	7.3	6.7	6 1	9 36	8.0	7 3	6.6	10 12	8.6	7.9	7.1	10 86	9 2	8 4	7 6	..	.		....
4 "x3 "	4 96	4 2	3.8	3.5	5.74	4 9	4 4	4 0	6 5	5 5	5.0	4 5	7 24	6.1	5.5	5.0	7.98	6.7	6.1	5.5	8 68	7.3	6.6	5 9	9 38	7.9	7.1	6.4	10 06	8 4	7 6	6 8		.	..	....
3½"x3 "	4 60	3 8	3.5	3 1	5.3	4 4	4.0	3 6	6.0	5 0	4.5	4 0	6 68	5.5	5.0	4.4	7.34	6 1	5.5	4.8	8 0	6 6	5.9	5 2	8.62	7.1	6.4	5.6	9 24	7.6	6.8	6 0	..	....	....	....
3½"x2½"	4 22	3 5	3.1	2 7	4 88	4 0	3.6	3.1	5.5	4 5	4 0	3.5	6.12	5 0	4 4	3.9	6 72	5.5	4 8	4 2	....	....	....	....	....	....	....	....	....	....	....	....	.	....	....	....

⅞-in. Rivets, Holes ⅛-in Larger.

Size, ins.	¼ ins.				5/16 ins.				⅜ ins.				7/16 ins.				½ ins.				9/16 ins.				⅝ ins.			
	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4	Gross	2	3	4
4 " x 4 "	....				..				5.72	5 1	4 7	4 4	6.62	5.8	5.5	5.1	7.5	6.6	6.2	5 7	8 36	7.4	6.9	6 4	9 22	8.1	7.6	7.0
3½" x 3½"						..	..		4 96	4 3	4 0	3 6	5 74	5 0	4 6	4 2	6.5	5 6	5 2	4 7	7.24	6.3	5 8	5 3	7.98	6.9	6 3	5.8
3 " x 3 "	2 88	2 4	2 2	2 0	3 56	3 0	2 7	2 5	4 22	3 6	3.3	2 9	4 88	4 1	3 7	3 3	5.5	1 6	4 2	3 7	6.12	5.1	4 6	4 1	6.72	5.6	5 1	4 5
2¾" x 2¾"	2 62	2 2	2 0	1 7	3 24	2 7	2 4	2 0	3 84	3 2	2 8	2 5	4 44	3.7	3 3	2 9	5.0	4 1	3 7	3 2	....				.	.	..	
2½" x 2½"	2 38	1 9	1 7	1 5	2 94	2 4	2.1	1 8	3.46	2 8	2 5	2.1	4 01	3.2	2 8	2.5	4 5	3 6	3 2	3 7	....				.	..	.....	.
6 " x 4 "									7 22	6.6	6 2	5 9	8 36	7 6	7.2	6.8	9 5	8 6	8 2	7 7	10.62	9 6	9.1	8 6	11 72	10 6	10.1	9 5
6 " x 3½"									6.84	6 2	5 9	5 5	7 94	7 2	6 8	6.4	9 0	8 1	7 7	7 2	10 06	9 1	8.6	8 1	11 1	10 0	9 5	8 9
5 " x 4 "									6 46	5 8	5 5	5.1	7 5	6 7	6 3	6 0	8 5	7 6	7 2	6.7	9 5	8 5	8 0	7 5	10 46	9 5	8 8	8 3
5 " x 3½"	...								6.1	5 4	5 1	4 8	7.06	6 3	5.9	5.5	8 0	7.1	6.7	6 2	8 94	8 0	7 5	7 0	9.84	8 7	8 2	7.6
5 " x 3 "									5 72	5 1	4 7	4 4	6.62	5 8	5.5	5 1	7 5	6 6	6 2	5 7	8 36	7 4	6.9	6 4	9.22	8 1	7 6	7 0
4½" x 3 "									5 34	4 7	4 3	4 0	6.18	5 4	5 0	4 6	7 0	6.1	5 7	5 2	7.8	6 8	6 3	5 8	8 6	7.5	7.0	6.4
4 " x 3½"									5 34	4 7	4 3	4.0	6.18	5 4	5 0	4.6	7 0	6.1	5 7	5 2	7 8	6.8	6 3	5.8	8 6	7.5	7.0	6.4
4 " x 3 "									4 96	4 3	4 0	3 6	5.74	5 0	4.6	4.2	6.5	5.6	5.2	4 7	7.24	6 3	5 8	5.3	7 98	6.9	6.3	5 8
3½" x 3 "					3 86	3 3	3 0	2 8	4 6	3.9	3 6	3 3	5.3	4 5	4 1	3.8	6.0	5 1	4.7	4 2	6 68	5.7	5 2	4 7	7 34	6.2	5.7	5 1
3½" x 2½"	2 88	2 4	2 2	2 0	3 56	3 0	2 7	2 5	4 22	3 6	3.3	2.9	4 88	4 1	3.7	3.3	5.5	4.6	4.2	3.7	6.12	5 1	4 6	4.1	6.72	5 6	5 1	4.5
3½" x 2 "	2 5	2 1	1 8	1 6	3 08	2 5	2 3	2 0	3.66	3 0	2 7	2 3	4 22	3 4	3.0	2 7	4 76	3 9	3.4	3.0	5 28	4.3	3.8	3 3		...	....	...
3 " x 2½"	2 62	2.2	2 0	1 7	3.24	2 7	2 4	2 1	3 84	3 2	2 8	2 5	4.44	3 7	3.3	2 9	5 0	4.1	3.7	3 2	5.56	4 6	4 1	3.6		....	.....	...

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*Consulting Engineer, Park Row Bldg., New York City.

Explosives in India.

According to the report of the Chief Inspector of Explosives of India, during 1906 there were 13 gunpowder accidents, causing 21 deaths and injury to 28 persons. Dynamite caused death and injury to 2 persons, and fireworks caused 4 deaths and injury to 14 persons. This remarkable showing for a country containing 300,000,000 people is explained by the fact that only a few people in India handle firearms and are allowed to handle explosives, powder and fireworks.

Methods and Costs; Some Old; Some New.

Maintaining Drainage Ditches.—In maintaining drainage ditches constructed through a sandy soil trouble is often caused by the sand washing and blowing into the ditch. To prevent this washing as much as possible willow posts are sometimes driven down 4 ft. apart at the side of the ditch and in time make a good protection against the water. To prevent the sand being blown in by the wind it is sometimes provided that a double row of willows be planted, about 100 or 150 ft. back from the bank. The willows are cut full length, 4 or 5 ins. in diameter, and laid in at an angle of about 30 degrees. They are buried about 3½ ft. deep and are spaced about 8 or 10 ft. apart.

Cushioned Foundation for Small Engines.—A cushioned foundation was used in overcoming engine vibrations caused by a 20 H. P. gas engine driving a 12½ k. w. lighting dynamo. The foundation consists of a 5 in. bed of concrete on which are laid ten 3x4½ in. timbers, spaced 6 ft. apart. Powerful helical springs were inserted in a series of 2-in. holes bored in the top of each timber. These springs, 48 in number, were capable of carrying 500 lbs. with ½ in. compression. The springs support a galvanized iron tray, 10 ft. long, 5 ft. wide, which contains a concrete base, 2 2-3 ft. thick, upon which the engine is erected.

Concrete in Freezing Weather.—In the contruction of dams for Huronian Company's power development in Canada a large part of the concrete work in dams, and also in power house foundations, was done in winter, with the temperature varying from a few degrees of frost to 15 degrees below zero, and on several occasions much lower. No difficulty was found in securing good concrete work, the only precaution taken being to heat the mixing water by turning a ¾-in. steam pipe into the water barrel supplying the mixer, and, during the process of mixing, to use a jet of live steam in the mixer, keeping the cylinder closed by wooden coverings during the process of mixing. No attempt was made to heat sand or stone. In all the winter work care was taken to use only cement which would attain its initial set in not more than 65 minutes.

Thawing Out Water Mains.—At Columbus, O., a 300 ft. long 10-in. water main across a bridge was thawed out by means of a steamer from the fire department. The pipe was first broken at one end and a jet of steam turned into it. A ¾-in. pipe was then used, through which the steam was forced. A machine is also used for steam thawing. This consists of an ordinary steam boiler placed in an upright position upon a wagon gear, and enclosed in much the same manner as are the wagons used to blow out beer faucets. The steam is generated by a gasoline burner, and the men operating the machine leave the shop with a pressure of steam of 60 to 80 lbs. They also carry about 200 ft. of ½-in. hose. The machine is pulled by one horse. It works very well in thawing out fire hydrants and has also been successfully used to thaw out short mains. The machine costs about $500 to construct.

Dust Prevention.—A new composition called "Apokonin" has been tried with some success as a dust preventive on the macadam streets of Leipzig. The material is thus described by Consul T. H. Norton, of Chemnitz: "It is a mixture of the heavier residual oils obtained in the distillation of coal tar with high boiling hydrocarbons. The method of mixing apparently involves a certain degree of chemical combination, in which phenol and similar constituents play a role. The manufactured material is prepared for use by heating in iron caldrons, identical with those used for asphalt, to temperatures ranging from 212° to 248° F. (100° to 120° C.). It is then sprayed evenly over the surface of a roadway with a special form of apparatus, and under such high pressure that the fluid mass penetrates to a certain distance into the upper layer of dust or dirt. The result is the formation of a compact lustrous black coating, which meets the demands of heavy traffic and is not disintegrated into dust particles. A marked advantage of the new process over the methods hitherto employed for the same purpose, and based upon the use of ordinary tar, is the total absence of odor after the application."

Making Soundings.—The following method was used in making soundings preliminary to filling in the tide lands at Seattle, Wash.: A raft was anchored at right angles to a base line spaced in 20 ft. stations. The raft was lined in the proper position with the transit and was located at any convenient distance up to about 2,000 ft. A wire tagged every 20 ft. with colored cloth, with a different color for the 100 ft. marks, was then made fast at the base line and run out from a reel in a boat until the raft was reached. The reel was then made fast to the raft and the wire wound up as tight as possible. In cases where the distance between the shore and the raft was more than a few hundred feet it was necessary to support the wire on small rafts to hold it above the water. A galvanized iron wire, of several strands, the size of a clothesline, was used. A tide gage was set, and a man stationed to note the time of each tenth of a foot rise and fall of the tide. The sounding party consisted of a leadsman, one or two oarsmen and a recorder to note the stations and the depth of soundings as called by the leadsman. From the notes thus taken, after the readings of the tide gage were entered with them, the elevations of the bottom were readily reduced. It was found unnecessary to stretch the wire for each line of soundings, as with range sights on the base line and an experienced crew, there was no difficulty in doing sufficiently accurate work up to 40 ft. on each side of the wire. That is to say, five lines of soundings were covered with each stretch of the wire one line under the wire, and two, respectively 20 and 40 ft. each side of it.

Handling Water in Trench Excavation.—In the construction of a 66-in. reinforced concrete sewer, the material encountered in excavation was loose black soil for a depth of 24 ft., and sand and gravel, water bearing for about 5 ft. at the bottom. The average depth of the trench was 18½ ft., with a width of 10½ ft. To handle the water a subdrain, pump and sump were used. The pipe used for subdrain was second class and cull pipe, laid with the invert 30 ins. below the invert of the main sewer. Joints were loosely calked with tufts of sod in order to hold back the fine sand, and the whole covered with clean gravel of medium size. The drain pipe emptied into a sump at the lower end of the new work, which was about 18 ins. below the subdrain grade, in which was a 6-in. rotary pump, used to discharge the water over a dam in the old portion of the sewer. Following this method it was possible to put the concrete in on a dry bottom. It was found necessary, however, to run the pump while the invert was being plastered, and it was kept going until the plastering was set, otherwise the water would force its way in from the outside and cause the mortar to slough down, leaving the bottom rough and the sides, to some extent, porous. The total cost of caring for the water per lineal foot of completed sewer was as follows:

Subdrain pipe	$0.33
Labor laying drain pipe	.35
Handling water	.45
Total	$1.13

The item handling water includes the fuel, housing and rental of pumping engine, pay of engineer, also sinking of two sump holes for the pump and filling up of same after the work was done. The engineer received $2 per 10 hr. day and common labor received $1.85.

The German Empire in 1901 had 9.4 kilometers of railway per 10,000 inhabitants.

In 1904 the total number of persons employed in all capacities by the railways of Germany was 582,370.

Florida East Coast Railway—Key West Extension.

BY HOWARD EGLESTON, C. E.*

II. ROADBED CONSTRUCTION.

The Florida Keys are all of coral formation. As the coral insect cannot live out of water he is compelled to stop his construction work when he reaches low water mark. If no volcanic action raises the keys above the sea level, they remain just below water level, sometimes covered with banks of sand which are thrown up by the sea during heavy storms, but quite frequently having nothing on them but the slight deposit gathered from the water by the roots of the mangrove bushes that cover them.

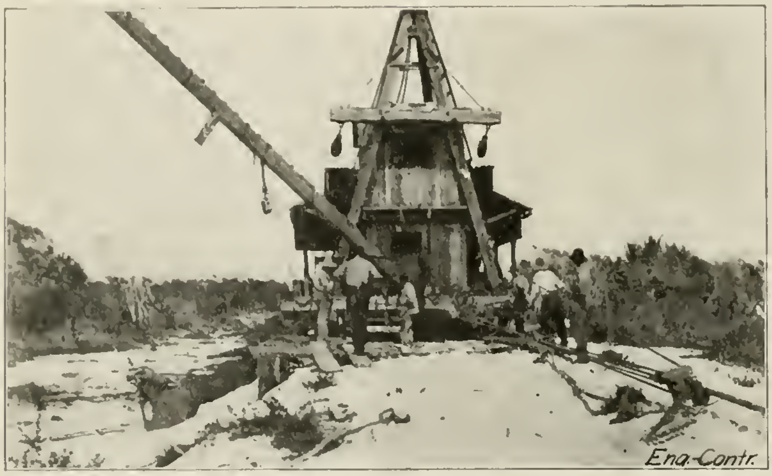

Fig. 1. Excavator No. 1 Being Moved Off the Grade at Lower Maticumbe.

Beginning at Homestead, the road runs through high pineland, the grade being practically on a level with the natural surface of the ground. About four miles from Homestead the prairie lands of the Everglades are reached and here began the first embankment work of the line.

The soil of these prairies is very deep. A large portion of it is covered with water at low tide, some of it is swampy, with occasional bunches of solid turf.

As in a considerable portion of the grade work, the mass of material for the embankment was below water level, the constructing engineer planned and built what he called excavators; the first one built is shown by Fig. 1 and needs little explanation. The boom being suspended in a fixed position, is swung by means of the hoisting and dumping cables that are led from the end of the boom through blocks placed at each end of a heavy cross timber and thence to the hoisting drums. The power is furnished by a 30 h. p. Otto gasoline engine operating two hoisting drums. The excavator was designed to work on land, building its own road with materials dug from ditches on either side. As the swinging of the boom was done by one of the hoisting cables, it is necessary to change their arrangement on the bucket in order to dig from the opposite side; for instance, if the material is to be taken from the right hand side and deposited in front of the machine, the cables leading from the right hand side will be attached to the apparatus that opens the bucket and that leading from the left hand to the apparatus for closing the bucket. Hoisting on the right hand cable will not only open the bucket, but will swing the boom to the right and bring the bucket over the ditch. After being dropped, the hoisting is done with the left hand cable, which not only closes the bucket, but swings the boom to the left; a slight strain on the right hand cable will prevent the boom swinging too far, but great care must be exercised or the contents of the bucket will be dumped. When over the place where the material is wanted, releasing the left hand cable and throwing all the weight of the bucket on the right hand cable will dump the bucket and return the boom to a position for more work.

The machine requires a captain, who handles the bucket, a mate, who is also the gas engineer, and a crew of ten men, the latter being occupied in leveling off the material thrown up by the machine, laying track and moving the machine forward. The machine is very heavy and clumsy, requiring constant repairs and having a strong propensity for getting off the track. Being carried on eight double flanged wheels, four on a side, all bolted rigidly to longitudinal 12x12-in. timbers, it is a difficult machine to get on the track, and still more difficult to transport any distance. I believe all who have had to do with these machines will agree that something in the nature of a locomotive crane would have done this work better and at much less cost.

The work through the Everglades was not done from the grade, but the excavators were mounted on lighters and dug a ditch for themselves as they proceeded. The material excavated was of a fibrous, peaty nature, which at first threatened to make a very poor road bed, but by allowing it to dry out and then hauling on a large quantity of broken stone as a dressing and for ballast, a good road bed has been secured. A mistake was made in cutting the ditch too near the embankment, in many cases leaving no berm. Had the ditch been 25 or 30 ft. from the center line of grade, a firm road bed would have been secured much easier and less trouble experienced from the mud "squashing" out from under the embankment into the ditch.

Just beyond Jewfish creek the road passes through a shallow lake, across which an embankment was thrown up by these floating excavators. This was very troublesome at first, but by a very liberal use of stone has been worked into good shape.

All through Key Largo the road is on coral rock, some of the way a cut of 2 or 3 ft. being necessary, but more commonly the road bed is built up by gathering up loose stones or blasting out pockets here and there, from which was taken what material was necessary to bring the road up to grade. On Plantation Key the rock is still higher, in one place, shown by Fig. 2, being about 8 ft. above grade. Here the company is now establishing a crushing plant and will use the rock for ballasting and filling in where now there are temporary trestles.

All this grade work on land, except as stated when the material was below water level, has been done in the most primitive way, with pick and shovel, wheelbarrows and two-wheel carts; in a few cases where the haul was long, dump cars and track were used in place of or to supplement the carts. The absence of the most ordinary labor saving machinery throughout the entire line has been very noticeable. Mr. Flagler's well known wish to give employment to as many men as possible may account for this.

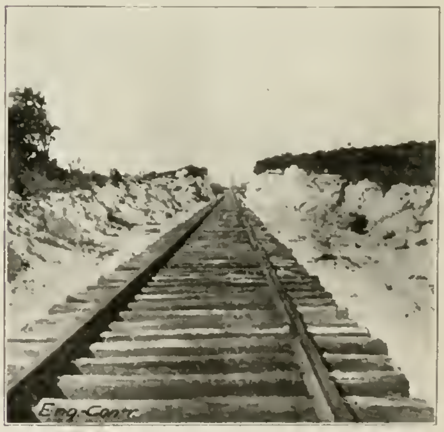

Fig. 2. Cut Through Coral Rock

On a few of the keys where there were considerable quantities of sand, the road was built up to grade with this material. On Lower Maticumbe we used an excavator to load cars, in our borrow pit, and in another we loaded by hand. An accurately kept account of cost showed the hand loading to be much cheaper than the excavator. This was partly due to the fact that the bank of sand being low we had to move the excavator frequently, and of course did no loading while moving.

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*Chattanooga, Tenn.

This "fill" was through a swamp, Fig. 3, which absorbed an enormous amount of material. The embankment was built from both ends. Stringers were first placed in the swamp 3 ft. apart. On top of these the crossties were laid, and to the ties the rails were spiked. Loaded cars were drawn by mules as far as possible and the car then pushed out by hand, dumped and brought back to be hauled away by the mules. When dirt had been dumped for about three rail lengths it was leveled off and the track moved from the stringers onto the dirt. The stringers having been taken up and carried ahead of the track now on the dirt, the place where the stringers had lain was filled with dirt from cars pushed out on the recently moved track. Dumping was continued on this portion, the track being "thrown" as often as necessary, until a firm road had been made for the mules, when, another section of track having been pushed out over the swamp, the above operations were repeated. When the foundation had been carried across the swamp in this manner the track was placed in the middle, the dirt dumped on each side and spread out evenly to the line of slope. When the embankment on each side of the track had been raised about 1 ft. above the track, the latter was thrown to one side and dirt dumped in the middle until a ridge was formed about a foot higher than the grade on either side; the track was then thrown back on this ridge and the work proceeded as before.

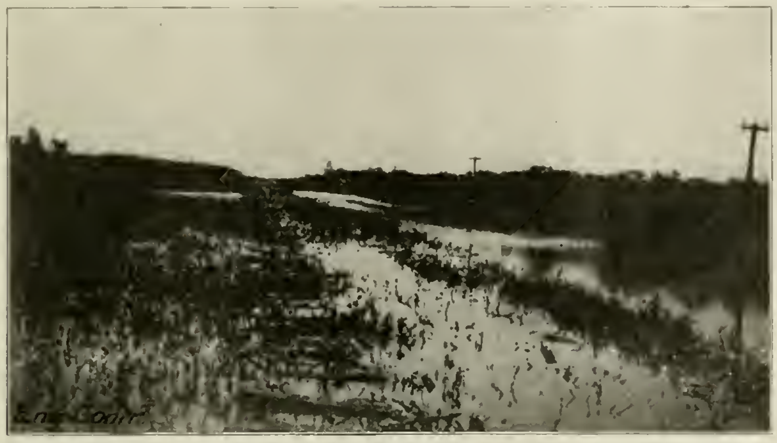


Fig. 3. View of Right of Way on Lower Maticumbe—The Interior of Many of the Keys is Like This.

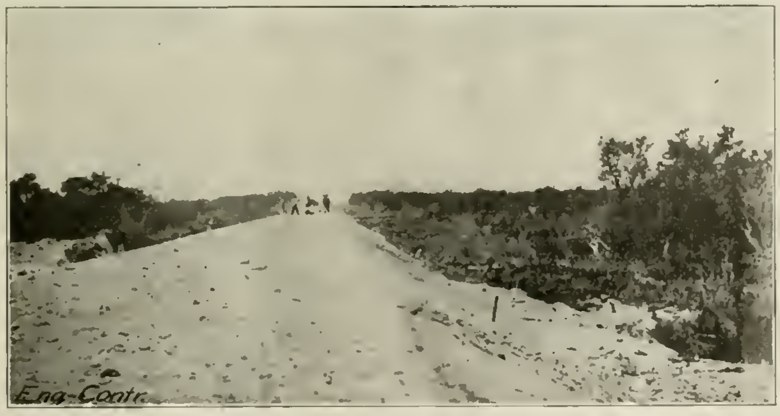


Fig. 4. View of Finished Grade at Point Shown in Cut No. 1, But Looking in Opposite Direction.

By building up the embankment in this way a very solid road bed was obtained and scarcely any settlement occurred. Fig. 4.

Three men were kept busy all the time leveling and raising track, as I consider it cheaper to keep even a temporary construction track in good order than to be all the time putting cars on the track after their having been dumped in the wrong place.

The production of all classes of asphalt, both natural and refined, including bituminous rock, in the United States in 1906, amounted to 138,059 short tons, valued at $1,290,340, as against 115,267 short tons, valued at $758,153, in 1905.

Methods and Cost of Building Macadam Roads in the State of Washington.

The general type of macadam road is adaptable to nearly all parts of the United States; the details of construction, however, may require modification to some extent to be suitable for different parts of the country. In past issues of ENGINEERING-CONTRACTING we have given considerable data on macadam road work; but these data have been mostly on work done in the east or the middle west. It will be interesting therefore to note the methods employed in some sections of the Pacific Coast. In a paper read recently before the Pacific Northwest Society of Civil Engineers by Mr. A. L. Valentine, County Engineer of King County, Washington, Mr. Valentine describes the methods employed in constructing roads in the State of Washington, and the matter that follows has been taken from that paper and from additional information furnished us by Mr. Valentine.

In the Washington road work, as far as possible, all drain pipe is of salt glazed vitrified sewer pipe. The tops of 6-in. pipe are placed at least 18 ins. below finished grade. The bottom of the trench is thoroughly tamped and brought to a true grade line and earth or clay filled about the pipe and over it for a depth of 1 ft. and carefully tamped. Concrete culverts are used, and the intakes of all drains and culverts are provided with ample wings of concrete, the concrete being also carried below the bottom of the intake.

After the drainage has been provided for and the center line properly marked, the stakes for the shoulders are set, 8 ft. on each side of the center line (if for a 16 ft. stone bed) and properly marked for subgrade or 6 ins. below finished grade.

The sub-grade is then shaped to conform exactly with the finished grade, the cross-section slope of which is at least ¾ in. to the foot; the shoulders are made at least 4 ft. wide with a slope of 1 in. to the foot, and in the case of embankments are built of firm earth, gravel and broken stone and thoroughly rolled. All stumps are excavated to a depth of at least 1 ft. below sub-grade and all such excavation refilled with good material and thoroughly tamped and sprinkled. All logs, stumps, unstable sand, soft clay, dust, mud, springy material or vegetable matter are removed and replaced with good material.

After the road has been properly shaped it is rolled with a 10-ton roller (a 15-ton roller is preferred), until it is hard and compact. If there are depressions, they are immediately filled with good material and re-rolled. The sides of the bed are rolled first, leaving the center until the last.

The first course of stone is spread to a depth of 5 ins., blocks of the required thickness being placed on the grade as a gage for spreading, which is done by hand or by spreader wagons. The first course of a size that will pass through a 3-in. ring and no larger. Broken stone or trap or basalt are generally used. The first course is rolled and all depressions forming filled and re-rolled, until there is no creeping under the roller.

The second course is spread in the same manner as the first course, and consists of stone which will pass through a 1½-in. ring. The stone is spread to a depth just sufficient to fill the voids of the first course.

Some specifications of other states call for the first course to be 4 ins. in depth and the second course to be of a sufficient depth to make the completed bed the required thickness. The experience in Washington, however, has been that the heavier stone or course No. 1 should be as thick as possible to make the required depth, allowing for shrinkage, and that course No. 2 should be of sufficient quantity to fill the voids.

After the two courses have been thoroughly compacted broken stone screenings, of a size that will pass through a ½-in. screen, containing all the dust of fracture, are spread evenly over the surface and thoroughly rolled before sprinkling; the road is then thoroughly sprinkled, the sprinkler being followed by the roller, and the rolling and sprinkling continued until all the voids have been filled and a grout of stone dust and water is formed on the surface. Care is taken to spread only enough screenings to cover the stone of the surface; depressions forming in the road are not filled with dust, but are filled with No. 2 stone and re-rolled. After the bed has been finally surfaced and is smooth, hard and compact, the shoulders are rolled, so as to give an uninterrupted, even surface, from the crown of the road to the side ditches; so that immediately the water falls it will run off the road.

Mr. Valentine states that the improvement should be started at the end of the road farthest from the source of supply of broken stone, and the courses carried along as near as practicable together; the reason for this being a road in the earlier stages of construction is not solid enough to permit of traffic, and where teams travel over the different courses, even after the first and second have been rolled, the wheel marks in the shape of depressions are found, which must be again filled with stone and re-rolled.

Regarding the allowance for shrinkage of broken stone, Mr. Valentine states that it has been their policy to allow one-third; that is, for a 6-in. stone bed to allow for 9 ins. of loose stone.

The cost of constructing several roads are given by Mr. Valentine.

Road No. 1 consisted of 6,600 lin. ft., 16-ft. stone bed, 6 ins. deep, containing, including turnout, 12,006 sq. yds. of macadam, the cost of this road being as follows:

	Per sq. yd.
Cost of stone	$0.44427
Cost of rolling	.03823
Cost of sprinkling	.01388
Cost of spreading	.04043
Cost of hauling	.08536
Total	$0.62217

This is equivalent to $5,838.17 per mile. Adding 25% for contractor's profit we would have $0.7777 per sq. yd., or a cost per mile of $7,300.00 for the stone bed only. The total number of cubic yards of stone used was 3,048, and 1 cu. yd. covered 3.93 sq. yds. The sizes of stone used was 66 per cent No. 1 (3 in.); 25 per cent No. 2 (1½ in.) and 9 per cent dust. The above represent the cost after the road bed had been shaped and was ready to be rolled. The cost of rolling does not include interest or depreciation; but does include wages, cost of fuel, oil and waste, water and repairs. The stone was delivered at Station 24, making the greatest haul 4,200 ft., Station 0 being the beginning. Regarding the stone dust, Mr. Valentine writes us that the dust secured from screenings is not all used in the road, there being considerably more produced than is necessary to properly build the stone bed; this excess is powdered and used in cement walk construction.

Mr. Valentine also inform us that the spreading is done by bottom dump wagons; a chain is put around the body of the wagon and the bottom allowed to spread about 6 ins., at which time the team is started and the load is spread along the center of the road bed; laborers then spread the stone with shovels even with the tops of the blocks previously mentioned.

Road No. 2 was 4,800 ft. long and was constructed during the wet season. It contained 1,869 cu. yds. of broken stone used in the following proportions: No. 1, 78 per cent; No. 2, 18 per cent; dust, 4 per cent. The difference in quantity between No. 1 and No. 2 as compared with Road No. 1 is caused by the fact that just enough of course No. 2 and the binder were used to fill the voids. Taking the number of cubic yards actually used (1,869 cu. yds.) and at the rate for car load lots delivered $1.75 f. o. b. cars, we have the following cost:

	Per sq. yd.
Cost of stone	$0.381
Rolling and sprinkling	.084
Hauling and spreading	.166
Total	$0.631

This is equivalent to $5,923 per mile. Adding a contractor's profit of 25% we would have $0.798 cts., or a cost per mile of $7,400 for the stone bed only. The above cost represents a maximum haul of 4,260 ft. in one direction and 3,700 ft. in the other, the stone being delivered between these points. On this road 1 cu. yd. covered 4½ sq. yds. No superintendence or interest are included in the above costs.

Road No. 3 was exactly one mile long, 10 ft. wide with a 6-in. stone bed and was constructed during dry weather. This road had been built two years, and had been entirely covered with water during the floods and the road beds exposed to the wash of the river current. This washed away the binder and softened up the bed so that it was badly rutted; owing to these conditions it was considered best to increase the width to 16 ft. This meant an increase in the crown and practically an entirely new road, both as regards quantity of material and labor. The entire bed was scarified by hand, that is, laborers were employed at $3 per day of 10 hours to pick up the stone bed before the first course was spread; this cost would about offset the cost of rolling the sub-grade of a new road, so that the item of sub-grade rolling shows in the summary of cost, but is really included in spreading and scarifying, and the cost of rolling is reduced in that proportion. The cost of this scarifying was $224, or about 0.38 cts. per square yard. On this road 1,792 cu. yds. of stone in the following proportions was used: No. 1, 75 per cent; No. 2, 22 per cent; dust, 6 per cent. The stone cost $1.75 per cubic yard, f. o. b. cars at Stations 39 and 70. The longest haul was 3,970 ft., the stone being hauled each way from Stations 39 and 70. The cost of the road was as follows:

	Per sq. yd.
Stone	$0.3340
Rolling	.0333
Sprinkling	.0269
Hauling, sprinkling, spreading	.1695
Total	$0.5637

Adding 10% to cover shrinkage and incidentals necessary on a new road on an ordinary foundation, $0.62, or $5,820.59 per mile, and 25% for contractor's profit, we would have $0.770 per sq. yd. or $7,275 per mile.

On this road there was used 1,792 cu. yds. of stone; had it been an ordinary foundation, allowing one-third shrinkage, 2,080 cu. yds. would have been used.

In this work 1 cu. yd. of stone covered 5.23 sq. yds. It was found that one tank of water covered 64 sq. yds., or 9.33 gallons per square yard, figuring each tank as holding 600 gallons. It was also found that the roller consumed one ton of coal in covering 383 sq. yds.

The wages paid per 10-hour day on this work were as follows:

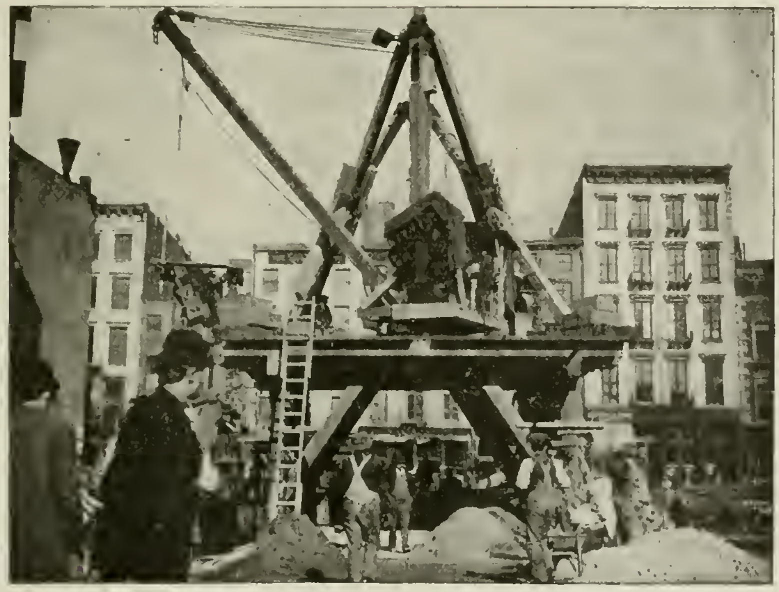
Foreman	$4.00
Rollerman	3.50
Teams	7.00
Laborers	3.00
Laborers	3.50

Water cost 15 cts. per tank of 600 gallons and coal cost $6.50 per ton. These wages and cost of water and coal will also apply to Roads No. 1 and No. 2. The cost of the above roads are for the stone bed only and do not include the cost of clearing, grubbing, grading and shaping.

The Merits of an Electric Mast Hoist.

Electric hoists are becoming more and more common on contract work, especially in cities. In places remote from electric stations it is often advisable to install an electric generator to furnish power for operating the different machines scattered over the site of the work.

Recently the Lidgerwood Manufacturing Co., of New York city, has put on the market a 20-h. p. electric mast hoist especially designed for contractors' use. The operating levers, brakes, etc., are located and handled just as they are on a Lidgerwood steam hoist. This makes it possible for any engineer, who is used to a steam hoist, to handle this electric hoist without having to relearn his trade. What is even more worthy of considerable, in certain places, is the fact that any bright laborer can quickly learn to operate an electric hoist. It requires no knowledge of electricity and of course no knowledge of steam engineering.



Traveler Carrying Two Electric Mast Hoists Sinking Caissons for Foundations of Hudson River Tunnel Terminal Buildings, Church Street, New York.

We illustrate herewith a traveler carrying two derricks, each operated by a Lidgerwood Electric Mast Hoist. On one of our advertising pages will be found a photograph of the hoist. With these electric hoists very much smaller travelers can be used than with steam hoists, not only because there are no boilers and engines but because no space is required for the leads necessary when bull wheel derricks and separate hoists are used.

The cost for electric current is very small, for it must be remembered that no derrick hoist is ever required to work continuously. The work is necessarily intermittent, and, when the electric hoist is not in operation, the power is off. Tests made by the New York Edison Co. show that handling buckets weighing 2,200 lbs. with their load requires only ½ kilowatt hour of current each time a bucket is raised out of the caisson, swung through an angle of 45 degrees, swung back again and lowered.

Assuming that electricity can be bought for 4 cts. per kilowatt hour, it costs only 2 cts. for each bucket lifted from the bottom of a caisson 100 ft. deep. Of course for ordinary derrick work, where the lift is much less, the cost is correspondingly less.

The reader will note that the Lidger-Electric Mast Hoist is complete in itself. It contains only one electric motor, which performs all the operations of hoisting and of swinging the derrick booms.

Cost of Taking Up and Relaying a Cobble Stone Pavement.

In repairing pavements, the costs of labor vary greatly, owing to the fact that the repair work is done in small patches and there is much time lost in the moving of tools from place to place as well as the time the men consume in moving. Records of these costs are exceedingly difficult to obtain, but we are fortunate in being able to give the cost of doing a repairing job that involved enough work to keep a repair gang busy for a day, so that some idea of the cost of the various labor items can be calculated.

The wages paid were as follows for an 8 hour day:

Foreman	$4.50
Laborers	1.66
Pavers	5.30
Rammers	3.90
2-horse wagon and driver	5.00
Cart and driver	3.50

The work consisted of cobble stone paving, between the curb and a street car track, being 10 ft. wide and 104 ft. long. A 10-in. gutter of flag stones was laid 15 ins. from the curb; the intervening 15 ins. being laid with cobbles. In all there were 115.55 sq. yds. of paving, 9.55 sq. yds. of this being in the gutter, and 14.55 sq. yds. being between the gutter and the curb.

The system of carrying on the work was for three laborers to loosen the cobbles with bars, being followed by three laborers with picks, who piled the stones within reach of the pavers and kept the ground beneath the paving loosened with their picks. A wagon hauled ashes from the city stock pile to be used beneath the new paving, and it also hauled some cobbles from the yard that were needed. One laborer spread the ashes for the pavers.

One paver set the gutter and paved between the curb and the gutter. The curbing was not disturbed. This paver laid 24 sq. yds. in the day, and, considering that more than one-third of it was gutter, it was a fair day's work. The other three pavers did the rest of the laying, doing not quite 31 sq. yds. apiece. Two rammers rammed 106 sq. yds. of paving, being the entire amount less the gutter. The man who spread the ashes followed the rammers spreading sand over the work. The cart hauled the sand. At the close of the day the 7 laborers cleaned up in a few minutes.

The various labor items cost as follows:

Tearing up and handling stone:		
3 laborers with bars	$4.98	
3 laborers with picks	4.98	
		$ 9.96
Paving:		
1 laborer on ashes and sand	$ 1.66	
4 pavers	21.20	
2 rammers	7.80	
Total		$30.66
Hauling materials:		
Cart sand	$3.50	
Wagon for ashes and stone	5.00	
Total		8.50
Superintendence		4.50
Grand total		$53.62

The cost per sq. yd. was:

Tearing up and handling stone	$0.086
Paving	.265
Superintendence	.040
Hauling materials	.073
Total cost per sq. yd	$0.464

The cobble stones averaged about 8 ins. deep, hence the cost of tearing them up and stacking them was nearly 40 cts. per cu. yd.

It is said that $13,320,000 have been collected by the Turkish Government for the Damascus-Mecca system and other railroads in Syria. It is believed that $6,000,000 more will be required to complete the railroad as far as Mecca. Five thousand soldiers are now at work on the line.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0365. **Pumping Machinery.**—John H. McGowan Co., Cincinnati, Ohio.

This firm manufactures a general line of pumping machinery, including boiler feed pumps, general and low service pumps and fire pumps. A number of patterns of each type of machine are made, and in this catalog each is described and illustrated, and cuts, dimensions, capacity, etc., given in tabular form. Some of the pumps are described in detail and illustrated by line drawings. The catalog is excellently printed and well written, and should prove of interest to those having to purchase pumping machinery of the kinds mentioned.

No. 0366. **Steam Shovels.**—The Ohio Steam Shovel Co., Toledo, Ohio.

This company issues a series of pamphlets, each of which is devoted to illustrating and describing one size of the steam shovel manufactured by them. The pamphlets before us cover 25, 30, 40, 50 and 60 ton shovels. Each size of shovel is illustrated by line drawings showing the main structural features and is given a general description, followed by a complete specification governing the construction of the shovel. The pamphlets are well written and illustrated for the purpose intended and really give a desirable lot of information about the machines to which they relate.

No. 0367. **Elevators and Conveyors.**—The Jeffrey Mfg. Co., Columbus, Ohio.

This is a general catalog of 372 pages, illustrating, describing and giving prices and capacities of the very complete line of elevating and conveying machinery manufactured by the company named. The catalog is profusely illustrated, many of the illustrations being half-tone views of plants actually constructed.

No. 0368. **Technical Paints.**—National Paint Works, Williamsport, Pa.

This pamphlet is devoted largely to a general essay on the requirements of a paint for protecting metal work. The essay is well written and takes up the subjects of pigments and vehicles, methods of applying paints, etc. The text is divided into sections covering reinforced concrete and cement coating, bridge paints, gas holder paints and structural iron work paints. Hints are given as to how to estimate the quantity of paint required for structures and as to the proper selection of colors to secure durability.

No. 0369. **Rock Crushers.**—Contractors' Supply and Equipment Co., Chicago, Ill.

The rock crusher described and illustrated in this pamphlet is known as the Symons Gyratory Crusher. This crusher was described in Engineering-Contracting of Sept. 4, 1907. It is particularly noted for its small height and size in proportion to its capacity, and for its ability to handle very large stones.

No. 0370. **Steel Wheelbarrows.**—Ohio Steel Wheelbarrow Co., Toledo, Ohio.

This pamphlet illustrates and describes a very large line of steel wheelbarrows for handling earth, concrete and other materials. Each style of barrow is illustrated and briefly described, and dimensions, prices, etc., are given.

No. 0371. **Trucks and Industrial Cars.**—Chase Foundry and Mfg. Co., Columbus, Ohio.

This pamphlet illustrates and gives very brief descriptions of each of the large line of trucks and cars for industrial purposes manufactured by the firm named. The one peculiarity of the construction of all of these trucks and cars is that the wheels are mounted on roller bearings. This gives an unusually easy-running vehicle, and a special point is made of the construction by the company named.

No. 0372. **Drawing Tables.**—Economy Drawing Table Co., Toledo, Ohio.

This firm manufactures a complete line of drawing tables and these tables are described in the pamphlet before us. In addition to drawing tables the pamphlet also describes filing cases and various other furniture used in drafting rooms. It gives complete instructions for ordering drawing tables and a large number of testimonial letters from those who have used the company's furniture.

No. 0373. **Water Filters.**—The Lynn Filter Mfg. Co., Cincinnati, Ohio.

The text and illustrations of this pamphlet explain in detail the construction of the special type of granule filter which is made by the company named above, for use in residences, hotels, apartment buildings, institutions, etc. The filter itself is first described in detail, and this description is followed by a number of line drawings showing arrangement of plants for different purposes and uses. There are also printed a number of tests which have been made to determine the purity of water filtered by these devices.

No. 0374. **Lifting Jacks.**—The Boyer-Radford and Gordon Tank and Pump Co., Dayton, Ohio.

This firm manufactures a full line of patent lever, screw and ratchet lifting jacks for track work and general purposes. The jack construction is described in considerable detail and illustrations, dimensions and prices are given of the various forms and sizes of jacks kept on the market by the firm.

No. 0375. **Curtis Steam Turbine-Generator.**—General Electric Co., Schenectady, N. Y.

This is an unusually well gotten up catalog. Its purpose is to describe in detail the construction and operation of the Curtis turbine connected with electric generators. An interesting portion of the pamphlet is the detailed tests given of various sizes of turbine generators from 9,000 kilowatts down to 1,000 kilowatts capacity. Anyone who is interested in the steam turbine as a motive power for electric generators will do well to secure this pamphlet and study it.

No. 0376. **Locomotive Cranes.**—Brown Hoisting Machinery Co., Cleveland, Ohio.

This pamphlet is devoted chiefly to illustrations of Brownhoist locomotive cranes equipped with grab buckets. A description and illustration is given of the patent ore bucket manufactured by the company, and there are also line drawings and brief descriptions of the cranes themselves.

No. 0377. **Cast Iron Pipe.**—United States Cast Iron Pipe and Foundry Co., New York City and Chicago, Ill.

This is one of the most interestingly written and printed catalogs which has come to our notice for a long time. Besides giving a full set of tables covering all lines of standard pipe and special castings, there is an exceedingly interesting introductory essay on the history and use of pipe of all kinds for conveying water, gas and other fluids. The book constitutes a really worthy little treatise on cast iron pipe construction and methods of laying such pipe for water works, gas works and similar purposes. To anyone who is at all interested in any feature of such work we recommend this pamphlet as being well worthy of obtaining and filing away in their catalog library.

No. 0378. **Core Drilling.**—The Cyclone Drill Co., Orrville, Ohio.

This is a very attractive catalog for those interested in core drilling. It illustrates machines made, method of operations, giving cuts of sample cores and prospecting machines at work. It also gives outfit of tools needed for various kinds of core drill, and comparative cost data on operating several kinds of core drills. This company also issues two other catalogs, one given over to description of drilling blasting holes with their machines and the other to well drilling.

No. 0379. **Earth and Rock Handling Machinery.**—Western Wheeled Scraper Co., Aurora, Ill.

This catalog illustrates and describes various kinds of scrapers, including buck scrapers, plows, road machines, elevating graders, cars, both side and bottom dump, flat cars, spreading cars for use in spreading earth on embankments, the Aurora dump wagon, dump carts, rock crushers and bins and many other tools made by this company. Claims of special merit are set forth for these tools, and those interested are invited to ask for copies of the catalog.

No. 0380. **Dump Chutes, Buckets and Machinery.**—Bergen Point Iron Works, Bayonne, N. J.

This is an illustrated and descriptive catalog of various transporting and dumping machinery for use in unloading vessels, handling earth, concrete, coal and other materials. Each machine is illustrated and described and types of special machines designed for handling materials are shown.

Personals.

Mr. Wm. H. McEniry has been elected City Engineer of Bessemer, Ala.

Mr. Ernest Machado, an architect of Salem, Mass., was drowned September 20 at Ossipee Lake, N. H., by the capsizing of a canoe.

Mr. J. C. Jeffery has resigned his position as Assistant City Engineer of Seattle, Wash., and has entered into a general contracting business with Mr. J. S. Holt, of Seattle.

Mr. W. A. Richards, formerly with Mr. D. W. Mead, Consulting Engineer, Madison, Wis., has accepted a position as instructor in the testing laboratory at the University of Pennsylvania.

Mr. B. T. Fendall has been reappointed City Engineer of Baltimore, Md. Mr. Alfred M. Quick was reappointed Water Engineer and Mr. Oscar F. Lackey was reappointed Harbor Engineer.

Mr. John F. Stevens, former Chief Engineer of the Panama Canal, has received from the canal employes as a testimonial of regard and esteem a magnificent silver service, a gold watch and a ring.

Mr. C. R. Moore has resigned as Superintendent of Construction of the Douglas, Ariz., sewer system now being constructed by the American Light & Water Co., Kansas City, Mo. He is succeeded by Mr. W. A. Dutch.

Mr. Albert Carr has resigned his position as Chief Engineer of the United Railroads of San Francisco to take the position of Superintendent of Construction on the Water Power Developments of the Central Colorado Power Co., with headquarters at Colorado Springs.

Mr. H. H. Taylor, of the firm of H. H. Taylor & Son, bricklaying contractors, of Philadelphia, Pa., was killed September 21 by falling down the areaway in the rear of a building under construction for the Girard Trust Co. in Philadelphia.

Colonel N. M. Ellis of Phoenixville, Pa., died Sept. 25 at his home in that city, aged 87 years. He entered the employ of the Philadelphia & Reading Ry. in 1832 as a civil engineer, and assisted in building the road from Philadelphia to Pottstown.

Mr. F. E. Golian, Civil Engineer, formerly at the Atlanta, Ga., office of the Virginia Bridge and Iron Co., has been placed in charge of the contracting office of the above company, which was recently transferred from Little Rock, Ark., to New Orleans, La.

Mr. Frederick L. Smith for the past six years in charge of the New York office of Mr. Joseph H. Wallace, the well known industrial engineer of New York and London, has opened an office at 5 Beekman St., New York, where he will engage in practice as an industrial engineer and specialist in structural steel and reinforced concrete.

Messrs. T. R. Cummins and H. W. Swanitz have formed a partnership under the name of Cummins & Swanitz, with offices in the Old Colony Building, Chicago, Ill. The new firm will conduct a general practice in railway and mining engineering and in estimating and superintending contract work. Mr. Cummins has been engaged with the J. G. White Co. for the past two and a half years in charge of electric railway constuction, and previous to this time was on the Panama Canal work and with the Illinois Central Railroad. Mr. Swanitz has a large experience in mining engineering.

Mr. J. W. Howard, Consulting Engineer on roads, streets and pavements, 1 Broadway, New York, has been called upon by the Commissioners of Accounts, of Mayor McClellan of New York, to assist Gov. Hughes, of New York, in his investigation of President John F. Ahearn, of the Borough of Manhattan, in respect to the bad state of asphalt and other pavements and the causes of their neglect. Some of these pavements are under guarantee contracts and should be repaired by the companies or their bondsmen. Other pavements are out of guarantee and should be repaired by the city.

Mr. George L. Heins, State Architect, of New York, died September 26 of meningitis at his summer home at Lake Mohegan, Westchester County. He was appointed by Governor Roosevelt Feb. 22, 1899. Mr. Heins was born in Philadelphia May 14, 1860. He studied for two years at the University of Pennsylvania before entering the Massachusetts Institute of Technology, from which he was graduated in the architectural course in 1882. He then formed a partnership with C. G. La Farge. The firm of Heins & La Farge designed the Protestant Episcopal Cathedral of St. John the Divine, on Morningside Heights; the interior of the Church of St. Paul the Apostle and the Church of the Incarnation, and the alterations of Grace Church, in addition to being the consulting achitects for the Rapid Transit Commission.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Oct. 2.	Ashtabula, O	Sept. 25
Oct. 2.	Evansville, Ind	Sept. 25
Oct. 3.	Fergus Falls, Minn.	Sept. 18
Oct. 3.	New York, N. Y	Sept. 25
Oct. 3.	Williamsport, Ind	Sept. 25
Oct. 3.	Evansville, Ind.	Oct. 2
Oct. 5.	Indianapolis, Ind	Sept. 25
Oct. 5.	Indianapolis, Ind	Sept. 25
Oct. 5.	Sugarleaf, Pa.	Oct. 2
Oct. 7.	Salem, Ind.	Sept. 11
Oct. 7.	Warren, O.	Sept. 18
Oct. 7.	Vevay, Ind.	Sept. 18
Oct. 7.	Vicksburg, Miss.	Sept. 18
Oct. 7.	Rushville, Ind	Sept. 25
Oct. 7.	Tipton, Ind	Sept. 25
Oct. 7.	Hammond, Ind	Sept. 25
Oct. 7.	Crown Point, Ind	Sept. 25
Oct. 7.	Kentland, Ind	Sept. 25
Oct. 7.	Ottawa, Kan.	Oct. 2
Oct. 7.	Lebanon, Ind.	Oct. 2
Oct. 7.	Fowler, Ind.	Oct. 2
Oct. 7.	El Dorado, Kan	Oct. 2
Oct. 7.	St. Clairsville, O	Oct. 2
Oct. 7.	Atchison, Kan.	Oct. 2
Oct. 7.	Lawrenceburg, Ind.	Oct. 7
Oct. 7.	Franklin, Ind.	Oct. 2
Oct. 8.	Harrisburg, Pa.	Sept. 18
Oct. 8.	Delphi, Ind.	Sept. 18
Oct. 8.	Vicksburg, Miss.	Sept. 18
Oct. 8.	Summit, Pa	Sept. 25
Oct. 8.	Hamilton, O	Sept. 25
Oct. 8.	Fargo, N. Dak	Sept. 25
Oct. 8.	Covington, Ind.	Oct. 2
Oct. 9.	Peru, Ind.	Oct. 7
Oct. 10.	Houston, Tex	Sept. 25
Oct. 10.	New York, N. Y	Oct. 2
Oct. 14.	Bellefontaine, O	Sept. 25
Oct. 14.	Los Angeles, Cal	Sept. 11
Oct. 14.	Fredericton, N. B.	Sept. 18
Oct. 15.	Dunrea, Man.	Sept. 4
Oct. 15.	Erie, Kan.	Sept. 18
Oct. 15.	Tacoma, Wash.	Oct. 2
Oct. 17.	Fort Logan Roots, Ark	Sept. 25
Oct. 19.	Canton, China	Sept. 4
Oct. 22.	Hamilton, O.	Oct. 2
Oct. 24.	Washington, D. C	Oct. 2
Nov. 15.	Glendive, Mont.	Oct. 2

Buildings.

Oct. 3.	Bayonne, N. J	Sept. 11
Oct. 3.	Salem, Mass	Sept. 25
Oct. 4.	New York, N. Y	Oct. 2
Oct. 5.	New Orleans, La	Sept. 11
Oct. 5.	Mount Healthy, O.	Sept. 18
Oct. 5.	Nat. Soldiers' Home, Cal	Sept. 25
Oct. 5.	Milwaukee, Wis.	Oct. 2
Oct. 5.	Milwaukee, Wis.	Oct. 2
Oct. 5.	Lafayette, Ind.	Oct. 2
Oct. 7.	Baltimore, Md.	Aug. 28
Oct. 7.	Fort Slocum, N. Y.	Sept. 18
Oct. 7.	Fort Flagler, Wash	Sept. 25
Oct. 7.	Philadelphia, Pa	Sept. 25
Oct. 7.	Decatur, Ind	Sept. 25
Oct. 7.	Fort Rosecrans, Cal	Sept. 25
Oct. 7.	Syracuse, N. Y	Oct. 2
Oct. 7.	Two Harbors, Minn	Oct. 2
Oct. 7.	New York, N. Y	Oct. 2
Oct. 8.	Paoli, Ind	Sept. 25
Oct. 8.	Kansas City, Mo	Oct. 2
Oct. 8.	Fort Lincoln, N. Dak	Oct. 2
Oct. 8.	Buffalo, N. Y	Oct. 2
Oct. 9.	Pittsburg, Pa.	Oct. 2
Oct. 9.	Baltimore, Md.	Oct. 2
Oct. 10.	Washington, D. C	Sept. 25
Oct. 10.	New York, N. Y	Oct. 2
Oct. 10.	Louisville, Ky.	Oct. 2
Oct. 12.	Prescott, Ariz.	Sept. 18
Oct. 12.	Fort Leavenworth, Kan	Oct. 2
Oct. 12.	Chicago, Ill.	Oct. 2
Oct. 14.	San Diego, Cal	Sept. 11
Oct. 15.	Las Animas, Colo	Sept. 25
Oct. 15.	Los Angeles, Cal	Sept. 25
Oct. 15.	East Stroudsburg, Pa	Oct. 2
Oct. 15.	Cairo, Ill.	Oct. 2
Oct. 15.	Indiana, Pa.	Oct. 2
Oct. 15.	Preston, Minn.	Oct. 2
Oct. 16.	Springfield, O.	Sept. 18
Oct. 16.	Harrisburg, Pa	Sept. 25
Oct. 16.	Polk, Pa.	Oct. 2
Oct. 16.	Harrisburg, Pa.	Oct. 2
Oct. 17.	Peoria, Ill.	Sept. 11
Oct. 17.	Fort McPherson, Ga	Sept. 25
Oct. 18.	Montenallo, Ala.	Sept. 18
Oct. 18.	Denver, Colo	Sept. 25
Oct. 20.	Hot Springs, Ark	Oct. 2
Oct. 21.	Des Moines, Ia.	Sept. 11
Oct. 21.	Milwaukee, Wis.	Sept. 18
Oct. 22.	Secaucus, N. J	Sept. 25
Oct. 28.	East St. Louis, Ill	Oct. 2
Oct. 30.	Terre Haute, Ind.	Sept. 18
Oct. 30.	Atlanta, Ga	Sept. 25
Oct. 30.	Columbus, O.	Oct. 2
Oct. 31.	Cleveland, O.	Oct. 2
Nov. 5.	Bloomfield, Ind.	Sept. 18
Nov. 5.	Bloomfield, Ind	Sept. 25
Nov. 5.	Flint, Mich.	Oct. 2
Nov. 9.	Las Animas, Colo	Sept. 25

Roads and Streets.

Oct. 2.	Brooklyn, N. Y	Sept. 25
Oct. 2.	Millvale, Pa	Sept. 25
Oct. 2.	Spencer, Ind	Sept. 25
Oct. 2.	Chicago, Ill	Sept. 25
Oct. 3.	Harrisburg, Pa.	Sept. 18
Oct. 3.	New York, N. Y	Sept. 25
Oct. 3.	North Braddock, Pa	Sept. 25
Oct. 3.	Lima, O.	Oct. 2
Oct. 3.	Emsworth, Pa.	Oct. 2
Oct. 3.	Philadelphia, Pa.	Oct. 2
Oct. 3.	Towson, Md.	Oct. 2
Oct. 3.	Evansville, Ind.	Oct. 2
Oct. 4.	Jackson, Mich.	Oct. 2
Oct. 4.	Port Huron, Mich	Oct. 2
Oct. 4.	Memphis, Tenn.	Oct. 2
Oct. 4.	Terre Haute, Ind	Oct. 2
Oct. 4.	Indianapolis, Ind.	Oct. 2
Oct. 5.	Cleveland, O.	Sept. 18
Oct. 5.	Milwaukee, Wis.	Oct. 2
Oct. 5.	Gary, Ind.	Oct. 2
Oct. 7.	Salem, Ind.	Sept. 11
Oct. 7.	Hartford City, Ind.	Sept. 18
Oct. 7.	Kenosha, Wis.	Sept. 18
Oct. 7.	Columbus, Ind	Sept. 25
Oct. 7.	Sullivan, Ind	Sept. 25
Oct. 7.	Decatur, Ind	Sept. 25
Oct. 7.	Brookside, Ind	Sept. 25
Oct. 7.	Indianapolis, Ind.	Oct. 2
Oct. 7.	Hartford, Conn.	Oct. 2
Oct. 8.	Vincennes, Ind.	Sept. 11
Oct. 8.	Covington, Ind.	Sept. 18
Oct. 8.	Monticello, Ind	Sept. 25
Oct. 8.	St. Louis, Mo	Sept. 25
Oct. 8.	Crawfordsville, Ind	Sept. 25
Oct. 8.	Palatka, Fla	Sept. 25
Oct. 8.	Portland, Ind	Sept. 25
Oct. 8.	Logansport, Ind	Sept. 25
Oct. 8.	Milwaukee, Wis.	Oct. 2
Oct. 8.	New York, N. Y	Oct. 2
Oct. 8.	Spracuse, N. Y	Oct. 2
Oct. 8.	Chicago, Ill.	Oct. 2
Oct. 8.	McKeesport, Pa.	Oct. 2
Oct. 8.	Rockville, Ind.	Oct. 2
Oct. 8.	San Luis Obispo, Cal	Oct. 2
Oct. 9.	Harrisburg, Pa.	Sept. 18
Oct. 9.	Bluffton, Ind	Sept. 25
Oct. 9.	Brooklyn, N. Y	Oct. 2
Oct. 10.	Harrisburg, Pa.	Sept. 18
Oct. 10.	Harrisburg, Pa	Sept. 25
Oct. 10.	Kansas City, Mo	Oct. 2
Oct. 10.	Chicago, Ill.	Oct. 2
Oct. 11.	Enid, Okla.	Sept. 25
Oct. 11.	Cincinnati, O	Sept. 25
Oct. 11.	Buffalo, N. Y	Oct. 2
Oct. 11.	Noblesville, Ind.	Oct. 2
Oct. 11.	Noblesville, Ind.	Oct. 2
Oct. 12.	Fort Wayne, Ind	Sept. 25
Oct. 12.	Rockport, Ind.	Oct. 2
Oct. 14.	Sunman, Ind.	Sept. 11
Oct. 15.	Oscala, Fla	Sept. 25
Oct. 15.	Denton, Md.	Oct. 2
Oct. 21.	Logansport, Ind	Sept. 25
Nov. 4.	Peru, Ind.	Oct. 2

Sewers.

Oct. 2.	Salem, Mass.	Sept. 18
Oct. 2.	Milwaukee, Wis	Sept. 25
Oct. 2.	Millvale, Pa	Sept. 25
Oct. 2.	Mingo Junction, O	Sept. 25
Oct. 2.	Fort Bayard, N. Mex	Sept. 25
Oct. 2.	Fort Crook, Neb	Sept. 25
Oct. 3.	Fort Dade, Fla.	Sept. 11
Oct. 3.	St. Paul, Minn	Sept. 25
Oct. 3.	Berwyn, Ill	Sept. 25
Oct. 3.	Lima, O.	Oct. 2
Oct. 4.	Boston, Mass.	Oct. 2
Oct. 4.	Columbus, O.	Oct. 2
Oct. 5.	Bisbee, Ariz.	Sept. 18
Oct. 5.	Milwaukee, Wis.	Oct. 2
Oct. 5.	Englewood, N. J	Oct. 2
Oct. 7.	Linton, Ind	Sept. 25
Oct. 7.	Rome, N. Y	Sept. 25
Oct. 7.	Vicksburg, Miss	Sept. 25
Oct. 7.	Chester, Pa	Oct. 2
Oct. 7.	St. Paul, Minn	Oct. 2
Oct. 7.	Flint, Mich.	Oct. 2
Oct. 7.	Indianapolis, Ind.	Oct. 2
Oct. 8.	New York, N. Y	Oct. 2
Oct. 8	New York, N Y	Oct. 2
Oct. 8.	Chicago, Ill.	Oct. 2
Oct. 8.	Kingston, Pa.	Oct. 2
Oct. 8.	Normal City, Ind	Oct. 2
Oct. 10.	McKeesport, Pa.	Oct. 2
Oct. 10.	St. Paul, Minn	Oct. 2
Oct. 11.	Aurora, Ind.	Oct. 2
Oct. 14.	Carthage, Mo	Sept. 25
Oct. 14.	Steubenville, O	Oct. 2
Oct. 15.	Chattanooga, Tenn.	Oct. 3
Oct. 15.	Elkhart, Ind.	Oct. 2
Oct. 23.	Whiterocks, Utah	Sept. 25

Water Supply.

Oct. 4.	South Bend, Ind	Sept. 25
Oct. 7.	Canon City, Colo	Sept. 25
Oct. 7.	Pierce, Neb.	Oct. 2
Oct. 7.	Sharpsburg, Pa.	Oct. 2
Oct. 7.	Newton, Miss.	Oct. 2
Oct. 9.	Fort Caswell, N. C.	Sept. 18
Oct. 9.	Fargo, N. Dak	Sept. 25
Oct. 10.	Primghar, Ia.	Sept. 18
Oct. 10.	Fort Du Pont, Del.	Sept. 18
Oct. 14.	Ashland, O	Oct. 2
Oct. 22.	Marion, Kan.	Oct. 2
Oct. 23.	Atlanta, Ga.	Sept. 18
Nov. 4.	Tucson, Ariz.	Oct. 2
Nov. 15.	Phoenix, Ariz.	Oct. 2

Miscellaneous.

Oct. 2.	Wilkesbarre, Pa.,	Walls,	Sept. 25
Oct. 3.	Wilmington, Del.,	Stone Jetties,	Sept. 11
Oct. 3.	New York, N. Y.,	Stone Wall,	Sept. 30
Oct. 3.	Brooklyn, N. Y.,	Fence,	Sept. 30
Oct. 3.	Boston, Mass.,	Subway Enlargement,	Sept. 25
Oct. 3.	Chicago, Ill.,	Chimney,	Oct. 2
Oct. 5.	Franklin Shoals, Ark.,	Lock and Dam,	Aug. 7
Oct. 5.	Mobile, Ala.,	Locks and Dams,	Aug. 14
Oct. 5.	Mobile, Ala.,	Locks and Dams,	Sept. 11
Oct. 5.	Vicksburg, Miss.,	Lock and Dam,	Aug. 14
Oct. 7.	Toledo, O.,	Riprap Wall,	Sept. 18
Oct. 7.	New Orleans, La.,	Flagstaff,	Sept. 18
Oct. 9.	Asbury Park, N. J	Jetties,	Sept. 25
Oct. 10.	New York, N. Y.,	Retaining Wall,	Oct. 2
Oct. 14.	Cincinnati, O.,	Concrete Wall, Etc.,	Sept. 25
Oct. 29.	Cincinnati, O.,	Track Work,	Oct. 2
Oct. 21.	Louisville, Ky.,	Steel Barges,	Sept. 25
Oct. 25.	Charleston, S. C.,	Dredge,	Sept. 25
Oct. 31.	Mobile, Ala.,	Snagboat,	Sept. 11
Nov. 15.	Charleston, S. C.,	Street Lighting,	Sept. 11
Nov. 20.	New Orleans, La.,	Dredge,	Oct. 2
Nov. 25.	Mobile, Ala.,	Locks and Dams,	Oct. 2

Excavation, Earth and Rock.

Oct. 2.	Falls, Pa.,	Dike,	Sept. 25
Oct. 7.	Detroit, Mich.,	Excavating,	Sept. 4
Oct. 7.	New York, N. Y.,	Tunnel,	Oct. 2
Oct. 7.	New York, N. Y.,	Excavation,	Oct. 2
Oct. 8.	Muscatine, Ia.,	Ditch Work,	Sept. 18
Oct. 8.	Detroit, Mich.,	Dredging,	Sept 4
Oct. 8.	Adrian, Mich.,	Ditch Work,	Oct. 2
Oct. 9.	Jacksonville, Fla.,	Dredging,	Sept. 18
Oct. 10.	Peterboro, Ont.,	Canal,	Sept. 4
Oct. 10.	Jacksonville, Fla.,	Rock Removal,	Sept. 18
Oct. 10.	Washington, D. C.,	Dredging, Jetty Work,	Sept. 18
Oct. 10.	Jersey City, N. J.,	Grading,	Sept. 25
Oct. 10.	Jersey City, N. J.,	Grading, Etc.,	Oct. 2
Oct. 11.	Boone, Ia.,	Drains,	Oct. 2
Oct. 12.	Riverton, Ala.,	Excavation, Riprap,	Sept. 18
Oct. 15.	Estherville, Ia.,	Ditch Work,	Sept. 25
Oct. 16.	Des Moines, Ia.,	Filling,	Oct. 2
Oct. 17.	Albany, N. Y.,	Dredging,	Sept 25

Oct. 21. Wilmington, Del., Dredging, Oct. 2
Oct. 22. St. Paul, Minn., Dredging, Sept. 25
Oct. 22. New Orleans, La., Canal, Oct. 2
Oct. 25. Ivanhoe, Minn. Ditch Work, Sept. 25

Materials, Machines, Supplies, Tools Etc

Oct. 2. Baltimore, Md., Pig Lead, Sept. 25
Oct. 4. Jacksonville, Fla., Generator, Etc., Sept. 11
Oct. 5. Washington, D. C., Launch, Hammers, Bolts, etc., Sept. 11
Oct. 5. Kewanee, Ill., Pumping Equipment, Sept. 18
Oct. 5. St. Louis, Mo., Steamboat, Sept. 25
Oct. 5. Union, W. Va., Pipe, Etc., Sept. 25
Oct. 5. Chicago, Ill., Steam Hammer, Oct. 2
Oct. 5. Chicago, Ill., Turret Lathe, Oct. 2
Oct. 7. Los Angeles, Cal., Cement Machinery, Sept. 25
Oct. 7. New Orleans, La., Lumber, Oct. 2
Oct. 8. New York, N. Y., Broken Stone, Sept. 25
Oct. 8. Norfolk, Va., Electric Supplies, Drills, Etc., Oct. 2
Oct. 8. League Island, Pa., Tools, Pipe, Etc., Oct. 2
Oct. 8. Sandusky, O., Fire Engine, Oct. 2
Oct. 8. New York, N. Y., Piles, Traprock, Etc., Oct. 2
Oct. 8. Annapolis, Md., Steel Work, Oct. 2
Oct. 8. Boston, Mass., Timber, Belting, Oct. 2
Oct. 8. Pensacola, Fla., Motors, Pipe, Etc., Oct. 2
Oct. 8. Washington, D. C., Drills, Pipe, Etc., Oct. 2
Oct. 10. Buffalo, N. Y., Boilers, Oct. 2
Oct. 10. Richmond, Ind., Broken Stone, Oct. 2
Oct. 11. Buffalo, N. Y., Boilers, Oct. 2
Oct. 14. Washington, D. C., Dynamite, Timber, Etc., Sept. 25
Oct. 14. Ashland, O., Water Pipe, Oct. 2
Oct. 15. Honolulu, T. H., Materials, Sept. 4
Oct. 15. Puget Sound, Wash., Timber, Bolts, Etc. Sept. 25
Oct. 15. Mare Island, Cal., Timber, Tools, Etc., Sept. 25
Oct. 16. Ottawa, Ont., Asphalt Plant, Oct. 2
Oct. 21. Louisville, Ky., Dump Scows, Sept. 25
Oct. 21. Chicago, Ill., Cement, Oct. 2
Oct. 21. Helena, Mont., Fire Hose, Oct. 2
Oct. 21. Washington, D. C., Pumps, Picks, Shovels, Etc., Oct. 2
Oct. 31. Cleveland, O., Mechanical Equipment, Oct. 2

BIDS ASKED.

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Until 10:30 a. m., Oct. 24, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing a steel railroad bridge—Canal Circular 394.

Covington, Ind.—Until Oct. 8, by County Commissioners, for constructing bridge in Jackson Township.

Franklin, Ind.—Until 1 p. m., Oct. 7, by County Commissioners, for constructing bridge.

Lawrenceburg, Ind.—Until Oct. 7, by Wm. S. Fagaly, County Auditor, for repair of bridge over South Hogan St., Aurora.

Evansville, Ind.—Until 10 a. m., Oct. 3, by Harry Stinson, County Auditor, for 3 reinforced concrete bridges.

Fowler, Ind.—Until noon, Oct. 7, by County Commissioners, for construction of 3 bridges.

Lebanon, Ind.—Until 10 a. m., Oct. 7, by County Commissioners, for construction of a bridge.

Peru, Ind.—Until Oct. 9, by Charles Griswold, County Auditor, for constructing following bridges: Steel bridge in Erie Twp., reinforced concrete arch in Jefferson Twp., flat top arch in Erie Twp., flat top arch in Deer Creek Twp., steel bridge in Butler Twp., reinforced arch in Butler Twp.

El Dorado, Kan.—Until 6 p. m., Oct. 7, by B. F. Allebach, City Clerk, for labor and material for stone arch bridge over weat branch of Walnut River at Central Ave.

Atchison, Kan.—Until Oct. 7, by County Commissioners, for rebuilding bridge No. 230, in Mount Pleasant Township.

Ottawa, Kan.—Until noon, Oct. 7, by Trustees Peoria Township, care County Commissioners, Court House, for abutments for bridge on Elm Branch.

Glendive, Mont.—Until 2 p. m., Nov. 15, by U. S. Reclamation Service, Washington, D. C., for construction and erection of 34 steel highway bridges in connection with Lower Yellowstone Project.

New York, N. Y.—Until 2 p. m., Oct. 10, by J. W. Stevenson, Commissioner of Bridges, 13 Park Row, for construction of bridge floor at Washington Ave., bridge, Brooklyn. Security required is $1,000.

Hamilton, O.—Until Oct. 22, by Chr. Pabst, County Auditor, for making channel cut, pipe culvert, and bulkheads and new concrete sub and superstructure of bridge on the Cincinnati and Dayton pike.

Saint Clairsville, O.—Until Oct. 7, by A. W. Beatty, County Auditor, for labor and material for repairing county bridges and retaining walls.

Sugarloaf, Pa.—Until 2 p. m., Oct. 5, by J. V. Oxenrider, care County Commissioners, Wilkesbarre, Pa., for abutments for Nescopec bridge in Sugarloaf Township.

Tacoma, Wash.—Until Oct. 15, by State Highway Commissioner, Olympia, Wash., for building 180 ft. span steel bridge over Washougal River.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Hot Springs, Ark.—Until 1 p. m., Oct. 20, by Capt. P. L. Boyer, Q. M., for constructing 1-story, brick, 33x56 ft. stable and carriage house.

East St. Louis, Ill.—Until 3 p. m., Oct. 28, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office and Court House at East St. Louis.

Cairo, Ill.—Until Oct. 15, by C. B. S. Pennebaker, for brick annex to Baptist church.

Chicago, Ill.—Until 11 a. m., Oct. 12, by Department Public Works, 322 City Hall, for labor and material for constructing truck house at 73rd St. and Dobson Ave.

Lafayette, Ind.—Until Oct. 5, by Trustees Purdue University for new experiment station. A $100 000 appropriation has been made for this building.

Fort Leavenworth, Kan.—Until 11 a. m., Oct. 12, by Capt. J. E. Normoyle, constructing Q. M., for furnishing and installing electric fixtures in 8 double sets non-commissioned staff officers' quarters, 1 double stable guard building and 2 quartermaster's stables, and electric wiring in 2 quartermaster's stables, at Fort Leavenworth.

Louisville, Ky.—Until noon, Oct. 10, by W. W. Davies, Chairman Board of Safety, for erection of a police station. Fred. Erhart, Arch., 409 Norton Bldg.

Baltimore, Md.—Until 11 a. m., Oct. 9, by Edward D. Preston, Inspector of Buildings, City Hall, to furnish and erect stalls and racks at the Retail Market and Maryland Institute.

Flint, Mich.—Until 3 p. m., Nov. 5, by James Knox Taylor, Supervising Architect, Washington, D. C., for construction, complete, of U. S. Post Office at Flint, Mich.

Preston, Minn.—Until Oct. 15, by J. O. Busted, Secy., R. R. 1, Whalan, Minn., for construction of a new church on or near site where Norwegian Lutheran church stands on Section 10-102-9.

Kansas City, Mo.—Until 2 p. m., Oct. 8, by Everett Elliott, Secy. Bd. Pub. Wks., for marble and tile floors for General Hospital.

New York, N. Y.—Until 2 p. m., Oct. 4, by Henry S. Thompson, Comr. Pub. Wks., for all labor and materials required for the alteration of the interior finish of the governor's rooms, City Hall, New York. Security required is $3,000. McKim, Mead & White, Archts., 160 Fifth Ave.

New York, N. Y.—Until 3 p. m., Oct. 10, by Park Board, Arsenal Bldg., 5th Ave. and 64th St., for constructing comfort station in Botanical Garden, Bronx Park. Security required is $2,500.

New York, N. Y.—Until 2 p. m., Oct. 7, by the Armory Board, for building armory at n. e. corner Franklin Ave. and 166th at. Security required is $100,000. C. C. Haight, Arch., 452 Fifth Ave. Bids are also aaked for changing system of atcam heating in 13th Regiment Armory. Security required is $900. Walter E. Parfitt, Arch., 26 Court St., Brooklyn.

Buffalo, N. Y.—Until 11 a. m., Oct. 8, by F. G. Ward, Comr. Pub. Wks., for installing hot water heating systema at Engine House No. 3 and Engine House No. 9.

Syracuse, N. Y.—Until 1:30 p. m., Oct. 7. by F. T. Pierson, Clerk Board Contract and Supply, for construction of Salina School.

Fort Lincoln, N. Dak.—Until 1 p. m., Oct. 8, by Bowers Davis, Constructing Q. M., for construction of one ice house, one commissary root cellar and addition to Q. M. stables.

Cleveland, O.—Until 3 p. m., Oct. 31, by James Knox Taylor, Supervising Architect, Washington, D. C., for the interior partitions and mason work of the U. S. Post Office, Custom House and Court House, Cleveland.

Columbus, O.—Until 10 a. m., Oct. 30, by Capt. H. B. Chamberlain, Constructing Q. M., Columbus Barracks, for construction of three double sets Lieutenants' quarters (including plumbing, heating, electric wiring and fixtures), one quartermaster's storehouse and one wagon shed.

East Stroudsburg, Pa.—Until 5 p. m., Oct. 15, by T. Y. Hoffman, Chairman Committee, for constructing normal school building.

Harrisburg, Pa.—Until 3 p. m., Oct. 16, by State Armory Board, State Capitol, for constructing armories at Grove City and Pine Grove. McCormick & French, Archs., Wilkesbarre, Pa.

Indiana, Pa.—Until noon, Oct. 15. by Oliver Fry, Secy., for constructing 16-room school.

Pittsburg, Pa.—Until 11 a. m., Oct. 9, by Department of Public Safety, John P. Brennan, Asst. Supt., for erection of police station.

Polk, Pa.—Until 2 p. m., Oct. 16, by John A. Wiley, Secy., Franklin, Pa., for erecting buildings, connecting corridors, fireproofing and tiling at Polk Institute for Feeble Minded. F. J. Osterling, Arch., Pittsburg, Pa.

Milwaukee, Wis.—Until 10:30 a. m., Oct. 5, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for furnishing and installing steam heating apparatus in fire engine houses No. 7 and No. 18.

Milwaukee, Wis.—Until 10:30 a. m., Oct. 4, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for constructing detention hospital in the third floor of the Johnston Emergency hospital.

Roads and Streets

Bids are asked on following work, the notes being arranged alphabetically by states:

San Luis Obispo, Cal.—Until 10 a. m., Oct. 8, by H. H. Carpenter, Clerk County Supervisors, for constructing Santa Rita and Old Creek Road, 14.56 miles long.

Hartford, Conn.—Until 11 a. m., Oct. 7, by James P. Berry, Secy. Board Contract and Supply, for about 7,500 sq. yds. of sheet asphalt paving.

Chicago, Ill.—Until 11 a. m., Oct. 10, by Department Public Works, 225 City Hall, paving with brick West Ravenswood Park.

Chicago, Ill.—Until 10:15 a. m., Oct. 8, by Board Local Improvements, 216 City Hall, for repairing with asphalt portion of North Halsted St.

Evansville, Ind.—Until 2 p. m., Oct. 3, by Harry Stinson, County Auditor, for constructing Henderson gravel road in Union Township.

Indianapolis, Ind.—Until 10 a. m., Oct. 4, by Board Public Works for 2 contracts for grading and paving roadways.

Indianapolis, Ind.—Until 10 a. m., Oct. 7, by Board Public Works for 1 contract for grading and paving roadway and 2 contracts for grading and paving sidewalks.

Noblesville, Ind.—Until 10 a. m., Oct. 11, by Commissioners of Hamilton and Clinton Counties, for constructing 2½ miles of gravel road.

Noblesville, Ind.—Until 1 p. m., Oct. 11, by N. W. Cowgill, County Auditor, for constructing 35 miles of gravel road.

Peru, Ind.—Until noon, Nov. 4, by Charles Griswold, County Auditor, for the establishment, grading, draining and paving of about 23½ miles of free gravel roads in Richland Township.

Rockville, Ind.—Until 1 p. m., Oct. 8, by H. A. Henderson, County Auditor, for constructing 2 gravel roads.

Terre Haute, Ind.—Until 4 p. m., Oct.

4, by Herbert Briggs, Secy. Bd. Pub. Wks., for improving 10½ St. Certified check for $400.

Gary, Ind.—Until 3 p. m., Oct. 5, by C. O. Holmes, Clerk Town Trustees, McCormick Bldg., for improvement of Madison St. and South Broadway by grading and paving with brick.

Rockport, Ind.—Until 10 a. m., Oct. 12, by Common Council, for constructing concrete pavements on Main and Third Sts.

Denton, Md.—Until noon, Oct. 15, by Isaac L. Dukes, Clerk County Commissioners, for grading and macadamizing 1¾ miles of road.

Towson, Md.—Until noon, Oct. 3, by H. G. Shirley, County Roads Engineer, for macadamizing Belvidere Ave.

Kansas City, Mo.—Until 11 a. m., Oct. 10, by E. A. Harper, City Engineer, for 3 contracts for paving alleys with brick, 6 contracts for paving with asphalt, 9 contracts for artificial stone sidewalks and 4 contracts for grading.

Jackson, Mich.—Until 7:30 p. m., Oct. 4, by J. F. Harrison, Supt. Pub. Wks., for paving portion of Wildwood Ave., 2,500 ft. in length; and 1st St., 700 ft. in length.

Port Huron, Mich.—Until 11 a. m., Oct. 4, by R. D. O'Keefe, Supt. Public Works, for cement sidewalk and curb around market.

Brooklyn, N. Y.—Until 11 a. m., Oct. 9, by Bird S. Coler, Borough President, for repaving with asphalt roadway of Bedford Ave. Security required is $20,000. Bids are also asked for 7 contracts for sidewalk construction.

Buffalo, N. Y.—Until 11 a. m., Oct. 11, by F. G. Ward, Comr. Pub. Wks., for paving Mississippi St., Mary St., Bartbel St. and Zittel St., and for macadamizing Domedion St.

New York, N. Y.—Until noon, Oct. 8, by George Cromwell, President Richmond Borough, St. George, New Brighton, for paving portion of Wooley Ave. with macadam, the work including 2,000 cu. yds. excavation, 20,300 sq. yds. macadam pavement and 5,750 sq. yds. vitrified brick.

Lima, O.—Until noon, Oct. 3, by L. L. Crumrine, Secy. Bd. Pub. Service, for grading Garfield Ave.

McKeesport, Pa.—Until 4 p. m., Oct. 8, by C. E. Sales, City Controller, for paving portions of 3 streets with vitrified brick.

Philadelphia, Pa.—Until 11 a. m., Oct. 3, by Jesse T. Vogdes, Chief Engineer, Fairmount Park, for constructing drive in Cresheim Valley.

Emsworth (P. O. Allegheny) Pa.—Until 6 p. m., Oct. 3, by John V. Sevins, 152 Beaver Ave., for 3,500 lin. ft. of curbing and 15,000 sq. ft. cement sidewalk. McBride Surveying & Engineering Co., Ltd., Borough Engineers, 516 Fitzsimmons Bldg., Pittsburg, Pa.

Memphis, Tenn.—Until 10 a. m., Oct. 4, by D. P. Prescott, Secy. County Supervisors, for hauling and spreading gravel in Mallory Ave.

Milwaukee, Wis.—Until 10:30 a. m., Oct. 5, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for resurfacing with asphalt several streets.

Milwaukee, Wis.—Until 10:30 a. m., Oct. 8, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for resurfacing several streets with asphalt.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Aurora, Ind.—Until 7 p. m., Oct. 11, by Frank D. Johnston, City Clerk, for constructing district sewer, pipe ranging from 6 in. to 20 ins. Estimated cost is $12,500.

Elkhart, Ind.—Until Oct. 15, by Board Public Works, for constructing large sewer in East Jackson St.

Normal City, Ind.—Until 8 p. m., Oct. 8, by J. G. Mendenhall, Town Clerk, for constructing outlet sewer consisting of 15 in., 20 in., 24 in. pipe sewer and 2x3 ft. brick sewer.

Chicago, Ill.—Until 10:15 a. m., Oct. 8, by Board Local Improvements, 216 City Hall, for 3 contracts for tile pipe sewers, 2 contracts for brick sewers and 12 contracts for drains.

Indianapolis, Ind.—Until 10 a. m., Oct. 7, by Board Public Works, for main sewer in Michigan St. Estimated cost is $145,000.

Boston, Mass.—Until noon, Oct. 4, by John J. Leahy, Superintendent of Sewers, 30 Tremont St., for sewerage works for Poplar St outlet, sec. 3.

Flint, Mich.—Until 3 p. m., Oct. 7, by D. E. Newcombe, City Clerk, for sewers in E. 5th St., Paterson St. and Stockston St.

St. Paul, Minn.—Until 2 p. m., Oct. 7, by R. L. Gorman, Clk. Bd. Pub. Wks., for sewer on west line of right of way of M. St. P. & S. Ste. Marie Ry. and on Case St.

St. Paul, Minn.—Until 2 p. m., Oct. 10, by R. L. Gorman, Clk. Bd. Pub. Wks., for constructing sewer in Lee Ave. and on Sturgis St.

Two Harbors, Minn.—Until Oct. 7, according to reports, by City Council for constructing 1,600 ft. of sewer laterals.

Englewood, N. J.—Until 3 p. m., Oct. 5, by Englewood Sewerage Co., Park Pl. and Dean St., for construction of 6,590 ft. of 12 in. sewer with manholes.

New York, N. Y.—Until noon, Oct. 8, by George Cromwell, President Richmond Borough, St. George, New Brighton, for work under 4 contracts for sewer construction.

New York, N. Y.—Until noon, Oct. 8, by George Cromwell, President Richmond Borough, St. George, New Brighton, for constructing temporary combined sewer and appurtenances in Richmond Terrace. Work includes considerable amount of reinforced concrete sewer, the security required being $20,000.

Syracuse, N. Y.—Until 2:30 p. m., Oct. 8, by E. L. Robertson, Clerk, High School Commission, for constructing sewer. Arcimedes Russell, Arch., 601 Snow Bldg.

Lima, O.—Until noon, Oct. 3, by L. L. Crumrine, Secy. Bd. Pub. Service, for grading Dingledine Ave. and constructing sewer.

Steubenville, O.—Until noon, Oct. 14, by T. W. Vance, Clerk Board Pub. Service, for labor and material for 232 ft., 36 in. brick sewer, 1,126 ft., 30 in. brick sewer and 1,721 ft., 12 in. to 24 in. pipe sewer.

Columbus, O.—Until noon, Oct. 4, by E. F. McGuire, Secy. Bd. Pub. Service, for construction of East Side sewerage pumping station and connections. Work includes 1,220 cu. yds. excavation, 415 cu. yds. concrete, brick masonry, carpenter work, etc.

Kingston, Pa.—Until noon, Oct. 8, by W. J. Williams, Clerk, for constructing 6 sewers. Young & Wintermute, Engineers, Wilkesbarre, Pa.

McKeesport, Pa.—Until 4 p. m., Oct. 10, by C. E. Sales, City Controller, for constructing two 15 in. terra cotta pipe sewers.

Chester, Pa.—Until 7:30 p. m., Oct. 7, by Samuel McClure, chairman board, for constructing 3 ft. sewer.

Chattanooga, Tenn.—Until 2:30 p. m., Oct. 15, by Board of Public Works, for construction of brick main sewer in Chestnut St., including the following: 36x54 in. egg-shaped sewer, 465.8 ft., 38x57-in. egg-shaped sewer, 465.9 ft., 42x63-in. egg-shaped sewer, 468.5 ft., 46x69-in. egg-shaped sewer, 466.4 ft., 50x75-in. egg-shaped sewer, 2,032.5 ft., 60-in. circular sewer, 175.0 ft.

Milwaukee, Wis.—Until 10:30 a. m., Oct. 5, by Charles J. Poetsch, Chairman Bd. Pub. Wks., for pipe sewer in Wright St.

Water Supply

Bids are asked on following work, the notes being arranged alphabetically by states:

Phoenix, Ariz.—Until 3:30 p. m., Nov. 15, by Robt. Craig, Superintendent of Water Works, for labor and materials for completion of contemplated improvements. The official advertisement will be found elsewhere in this issue.

Tucson, Ariz.—Until 8 p. m., Nov. 4, by Frank S. Treat, City Recorder, for labor and material for construction of a system of water works.

Newton, Miss.—Until 2 p. m., Oct. 7, by Mayor and Aldermen, for material and construction of complete water works. Xavier A. Kramer, Engineer, Magnolia, Miss.

Pierce, Neb.—Until Oct. 7, by Hason Turner, City Clerk ,for laying 1,680 ft., 4 in. cast water mains with one reducer, fire hydrants and all necessary fittings.

Ashland, O.—Until Oct. 14, by Board Public Affairs, for labor and material for laying about 8,500 ft. of water pipe, erecting building at pumping station and building foundations for new machinery.

Sharpsburg, Pa.—Until 5 p. m., Oct. 7, by A. H. S. Black, Borough Clerk, for labor and materials for putting down system of wells and laying cast iron suction pipe at pumping station.

Marion, Kan.—Until 3 p. m., Oct. 22, by Thos. W. Bown, City Clerk, for (1) furnishing cast iron pipe and special castings, (2) furnishing hydrants and valves, (3) furnishing and installing machinery, laying pipe, constructing well, power house, tower foundations, etc. Burns & McDonnell, Engineers, Kansas City, Mo. The official advertisement will be found elsewhere in this issue.

Excavation—Earth and Rock

Bids are asked on following work, the notes being arranged alphabetically by states:

Wilmington, Del.—Dredging.—Until 11 a. m., Oct. 21, by Maj. C. A. F. Flagler, U. S. Engrs., for dredging new entrance to Broadhill River, Del.

Boone, Ia.—Drains.—Until 1 p. m., Oct. 11, by E. F. Jones, County Auditor, for constructing county drains Nos. 31, 32 and 34, consisting of 1,300 ft., 32 in. tile work, 2,000 ft. 28 in., 3,700 ft., 26 in., 2,635 ft. 24 in., 4,000 ft., 22 in., 4,750 ft. 20 in., 2,900 ft., 18 in., 1,650 ft., 15 in., 10,150 ft. 14 in., 6,822 ft., 12 in., 5,750 ft., 10 in., 5,250 ft., 8 in., 5,700 ft., 6 in., and 650 ft., 5 in. tile.

Des Moines, Ia.—Filling—Until 11 a. m., Oct. 16, by Board Public Works, for about 1,160 cu. yds. earth filling in city lots.

New Orleans, La.—Canal.—Until Oct. 22, by Board of State Engineers, Cotton Exchange Building, New Orleans, for construction of Cancienne canal in Assumption Parish; length of line about 8,500 feet, requiring about 250,000 cu. yds. excavation.

Jersey City, N, J.—Grading, etc.—Until 9 p. m., Oct. 10, by Board of Education, City Hall, for improving grounds of School No. 18. John T. Rowland, Jr., Arch., 15 Exchange Pl.

New York, N. Y.—Excavation—Until 2 p. m., Oct. 7, by the Armory Board, for all work and materials required in excavating the plot for proposed armory building for the Second Battery, N. G., N. Y., at corner of Franklin Ave. and East 166th St. Security required is $15,000. C. C. Haight, Arch., 452 Fifth Ave.

New York, N. Y.—Tunnel.—Until 3 p. m., Oct. 7, by Board Trustees, Bellevue and Allied Hospitals, care Contract Clerk, 419 E. 26th St., for all the labor and materials required for a tunnel connecting the training school for women nurses with pavilions A and B of the new Bellevue Hospital. Security required is $6,000.

Adrian, Mich.—Ditch Work.—Until 10 a. m., Oct. 8, by Hope Welch, County Drain Commissioner, for constructing of drain, 384 chains long, with bottom width of 2 ft.

Miscellaneous

Bids are asked on following work, the notes being arranged alphabetically by states:

Mobile, Ala.—Locks and Dams.—Until 11 a. m., Nov. 25, by Maj. H. Jervey, U. S. Engrs., for building locks and dams No. 14 and 15, Black Warrior River, Ala., and lock tenders' houses.

Chicago, Ill.—Chimney.—Until 11 a. m., Oct. 3, by Department Public Works, 221 City Hall, for constructing chimney at 95th St. sewage pumping station.

New Orleans, La.—Dredge.—Until Nov. 20, by Col. E. H. Ruffner, U. S. Engrs., for construction and delivery of wooden hull combined hydraulic dredge and snag boat.

New York, N. Y.—Retaining Wall.—Until 3 p. m., Oct. 10, by Park Board, 5th Ave. and 64th St., for constructing retaining wall on Spuyten Duyvil Parkway. Security required is $1,000.

Cincinnati, O.—Track Work.—Until noon, Oct. 29, by Elmer G. Prior, Clerk Commissioner of Water Works, for constructing narrow gage coal and ash handling tracks, also for furnishing and delivering the material for said tracks, and for laying the same, at the river and main pumping stations of Cincinnati.

Materials, Machines, Supplies, Tools, Etc

Bids are asked for the following, the notes being arranged alphabetically by states:

Phoenix, Ariz.—Water Pipe.—See under Bids Asked—Water Supply.

Washington, D. C.—Pumps, Picks, Shovels, Etc.—Until 10:30 a. m., Oct. 21, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Circular 393, pumps, monitor nozzle, truck wheels and rockers for engines, shower heads, stop cocks, wash-tray plugs, brass ferrules and hubs, lead pipe, soil pipe and fittings, brass clean-outs, hose, chain, track bolts, steel, zinc, hand cars, wheelbarrows, jacks, track tools and drills, picks, shovels, tool handles, coke forks, hammers, cant hooks, timber carriers, scythes, grindstones, anvils, stocks and dies, turn-buckles, tacks, adhesive tape, sheet fiber, R. R. flags, lantern globes, fire brick, lights, candles, hame straps, desks, tables, chairs, filing cabinets, guide cards, Manila folders, lumber, etc.

Washington, D. C.—Drills, Pipe, Etc.—Until 10 a. m., Oct. 8, by Bureau Supplies and Accounts, for furnishing the following at Navy Yard, Washington.—Schedule 349—Twist drills, hack saw frames and blades, Renshaw ratchet drills, alundum wheels, parts for air drills, arbors, vises, iron pipe, brass and iron unions, iron pipe fittings, bibbs, valves. Schedule 350—Cold drawn steel, garden hose, etc.

Pensacola, Fla.—Motors, Pipes, Etc.—Until 10 a. m., Oct. 8, by Bureau Supplies and Accounts, Washington, D. C., for furnishing following at local navy yard: Schedule 334—Motors, waterproof cable, iron rivets, mild steel, steel and iron pipe, valves, iron and steel pipe fittings. Schedule 335—Copper pipe.

Richmond, Ind.—Broken Stone.—Until Oct. 10, by County Commissioners, for furnishing broken stone for repair of county roads.

Chicago, Ill.—Turret Lathe.—Until 11 a. m., Oct. 5, by James Horan, Fire Marshal, 20 City Hall, for furnishing one improved turret lathe.

Chicago, Ill.—Steam Hammer.—Until 11 a. m., Oct. 5, by James Horan, Fire Marshall, 20 City Hall, for furnishing one steam hammer.

Chicago, Ill.—Cement.—Until 2 p. m., Oct. 21, by U. S. Reclamation Service, 876 Federal Bldg., Chicago, for furnishing 12,000 bbls. Portland cement, f. o. b. cars at work of bidder. The official advertisement will be found elsewhere in this issue.

Marion, Kans.—Pipe, Hydrants.—See under Bids Asked—Water Supply.

New Orleans, La.—Lumber.—Until 1 p. m., Oct. 7, by City Comptroller, for furnishing the Department of Public Works with lumber for a period of one year.

Boston, Mass.—Timber, Belting.—Until 10 a. m., Oct. 8, by Bureau Supplies and Accounts, Washington, D. C., for furnishing following at local navy yard: Schedule 352—Yellow pine decking. Schedule 353—Leather belting, tool steel.

Annapolis, Md.—Steel Work.—Until 10 a. m., Oct. 8, by Bureau Supplies and Accounts, Washington, D. C., to furnish at Naval Academy the following: Schedule 347—Material for two steel towers. Schedule 348—Electrical supplies, hardware and tools, sheet copper, bar iron, tool steel, sextants, artificial horizons, barometers, etc.

Helena, Mont.—Fire Hose.—Until Oct. 21, by Martin Doty, City Clerk, for furnishing 1,000 ft. 2½ in. fire hose.

Buffalo, N. Y.—Boilers.—Until 11 a. m., Oct. 10, by F. G. Ward, Commissioner Pub. Wks., for 4 600 H.-P. boilers for city pumping station.

New York, N. Y.—Piles, Trap Rock, Etc.—Until 10 a. m., Oct. 8, by Bureau Supplies and Accounts, Washington, D. C., for furnishing following at local navy yard: Schedules 311 and 344—Wireless telegraph apparatus. Schedule 345—Gravel or trap rock, sand, piles. Schedule 347—Switches, running lights, lenses, rugs, cork. Schedule 351—Sheet copper Schedule 352—Yellow and white pine, mahogany, walnut, and ash.

Buffalo, N. Y.—Boilers.—Until 11 a. m., Oct. 11, by F. G. Ward, Commissioner Pub. Wks., for installing two new boilers in Central High School building.

Ashland, O.—Water Pipe.—Until Oct. 14, by Board Public Affairs, for furnishing and delivering about 350 tons cast iron water pipe and 14,000 lbs. pig lead.

Ottawa, Ont.—Asphalt Plant.—Until 5 p. m., Oct. 16, by N. J. Ker, City Engineer, for supply and erection of asphalt and bituminous paving plant.

Cleveland, O.—Mechanical Equipment.—Until 3 p. m., Oct. 31, by James Knox Taylor, Supervising Architect, Washington, D.C., for the mechanical equipment (except elevators) of the U. S. Post Office, Custom House and Court House at Cleveland, O.

Sandusky, O.—Fire Engine.—Until Oct. 8, by Board Public Service, for supplying 1 first class steam fire engine.

League Island, Pa.—Tools, Pipe, Etc.—Until 10 a. m., Oct. 8, by Bureau Supplies and Accounts, Washington, D. C., for furnishing following at local navy yard: Schedule 312—Planer and matcher, band saw, molding and scroll machines, planer and jointer, rip saw, sandpapering machine, smoothing planer, scroll saw, knife grinder. Schedule 345—Soil pipe, plumbing supplies. Schedule 349—Electric and air drills, steel squares, etc., air hammers, tools. Schedule 350—High-speed steel, pneumatic hose. Schedule 351—Twist drills, metal-slitting saws, taps and dies, tool holders, expansion boring tools, hand cart, tools.

Norfolk, Va.—Electric Supplies, Drills, Etc.—Until 10 a. m., Oct. 8, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at local navy yard, a quantity of naval supplies, among which are: Schedule 346—Double braided wire, cabinet and panel board, electric chandeliers, etc., globes and reflectors, electric fittings. Schedule 349—Tools, pneumatic drills, vises. Schedule 352—Hackmatack knees. Schedule 353—Condenser tubes.

CONTRACTS LET.

The following contracts have been let recently:

Sheffield, Ala.—Pavement. — Foster & Creighton, Nashville, Tenn., of three miles of pavement.

Oakland, Cal.—Sewers.—Michael Murphy, sewer in E. 25th and 26th Sts.; Ransome Construction Co., sewer in 47th St.; Piedmont Paving Co., sewer in Spring St.

Denver, Colo.—Sewer System.—National Construction Co., Denver, at $111,363 for constructing sanitary sewer system in Sub-District 8.

New Haven, Conn.—Sewers.—Thomas F. Maher, 3 contracts at $3,547; Dwyer & Mannix, 3 contracts at $4,026.

Clayton, Ga.—Court House.—Falls City Construction Co., Louisville, Ky., at $20,000.

Wallace, Idaho.—Railroad.—Pacific Coast Construction Co., Portland, Ore., is stated to have been awarded the contract for the construction of the 33-mile line of the Idaho Northern R. R., from Kingston, Idaho, to Murray, the metropolis of the north side of the Coeur d'Alenes. The cost of the line will be approximately $875,000.

Iowa City, Ia.—Building.—James Rowson & Son, Iowa City, at $50,600, for new wing to Engineering Hall, at Iowa University, to be built of Bedford stone.

Greenup, Ill.—Bridge.—Sullivan Bridge Co., at $1,990 for bridge near Union Center.

Rock Falls, Ill.—Bridge.—Clinton Bridge & Iron Works, Clinton, Ia., at $3,755 for bridge over Howland Creek, to have concrete floor and piers.

Indianapolis, Ind.—Sewers, Paving, etc.—T. J. Markey & Co., for local sewers in alley south of Washington St. and in Maryland St.; A. Bruner Co., local sewer; Indianapolis Construction Co., grading Montcalm St.; American Construction Co., paving Chesapeake St. with brick; Henry Pothast, constructing cement sidewalks on Vermont St.

Newcastle, Ind.—Heating Plant.—Powell & Doisette, Anderson, Ind., installing heating plant for trustees State Epileptic Village.

Evansville, Ind.—Bridges.—Lafayette Engineering Co., Lafayette, Ind., contract for bridges for extension of Evansville & Southern Indiana Traction Co., from Princeton to Patoka.

Frankfort, Ind.—Gravel Road.—Burt E. Dunn, Frankfort, contract for 18,400 ft. gravel road at $6,495.

Michigan City, Ind.—Car Barns.—Ohming Bros., Michigan City, for Hanna car barns.

Layfatte, Ind.—Foundation Work.—Wm. F. Stillwell, Lafayette, for substructure of Purdue University Experiment Station.

Terre Haute, Ind.—Macadam Road.—Wm. F. and Fred Tiffin, for Dickerson Road at $4,700.

Fort Wayne, Ind.—Concrete Work.—Moellering Construction Co., Fort Wayne, for concrete tunnels at Concordia College to connect with central heating plant.

Lawrence, Kan.—Building. — Manhattan Construction Co., Manhattan, Kan., for engineering building at Kansas University to cost $84,000.

Hopkinsville, Ky.—Pike Road.—Oriental Construction Co., Hopkinsville, at $48,083, for 27 miles of pike road.

Baltimore, Md.—Paving.—Wm. L. Elder, at $80,840 for paving Wilkens Ave. with asphalt.

Gladstone, Mich.—Paving, Sewers.—Northern Construction & Engineering Co., Escanaba, Mich., contracts for about $30,000 worth of sewers and macadam pavement.

Port Huron, Mich.—Bridges.—Port Huron Bridge & Iron Co., for three bridges for Port Huron Township.

St. Paul, Minn.—Ditch Work.—Arpin Bros., Thief River Falls, Minn., for four state drainage ditches requiring about 180,000 cu. yds. excavation.

Duluth, Minn.—Sewer.—Anderson, Johnson & Co., at $4,300 for 1,280 ft. of sewer at proposed county asylum for insane.

St. Peter, Minn.—Grading, Graveling—John Keough, St. Peter, for 2 miles of grading and graveling on Fort Ridgely Road.

Fargo, N. Dak.—Bridges.—Jardine & Anderson, for 120 ft. bridge and 40 ft. bridge at $10.85 per lineal foot.

Salem, N. J.—Iron Bridge.—New Jersey Bridge Co., at $11,025 for bridge in Upper Penn Neck.

South Orange, N. J.—Sewers.—Pasquale Cestone, Montclair, N. J., at $17,463, for sewer in Maplewood section; James J. Fusco, Montclair, at $21,206 for sewer in South Orange Heights section.

Cazenovia, N. Y.—Pipe Laying.—E. J. Smith and Frank L. Jones, Rome, N. Y., laying 5,500 ft 4 in. water main.

Rochester, N. Y.—Water Mains.—Whitmore, Rauber & Vicinus, at $7,433 for water mains.

Cincinnati, O.—Sewer, Water Mains.—Thos. P. Strack, 8th and Plum Sts., Price Hill sewer at $77,480; Augustine Silk at $9,000 for laying water mains.

Cleveland, O.—Pittsburg Construction Co., Pittsburg, Pa., for B. & O. R. R., bridge at Cleveland; to be 250 ft. long and of single leaf Scherzer rolling lift type.

Canton, O.—Sewer.—John Skeeles for constructing sanitary sewer.

Norwalk, O.—Sewer.—Penny & Corron, Lorain, O., at $24,285, for constructing concrete storm water and sanitary sewers.

Guthrie, Okla.—Railroad Work.—W. R. Stubbs Construction Co., has contract for building Cherryvale, Oklahoma & Texas R. R., from Caney, Kan., southwest to Guthrie and Kingfisher, 215 miles.

Brockwayville, Pa.—Railroad Work.—Frank Shumaker, Bellefonte, Pa., for double tracking Buffalo, Rochester & Pittsburg Ry., at Brockwayville.

Erie, Pa.—Paving.—Mayer Bros., for paving German St.

Philadelphia, Pa.—Bridges, Sewers.—Contracts for bridges and sewers have been let as follows: Bridge over the Pennsylvania R. R., at Belmont and Girard Ave., M. & J. B. McHugh, Witherspoon Bldg., $69,323; bridge over Pennsylvania R. R., at 31st St. and Columbia Ave., McGaw & Gray, Penn Bldg., $47,700; bridge over Newton branch, Philadelphia & Reading, Ry., on line of Torresdale Boulevard, Richard Walsh, $41,000; bridge over Tacony Creek on line of Torresdale Boulevard, D. J. McNichol & Co., $94,949. The sewer contracts were awarded as follows: Thomas Run, extension Lombards & Pascuzzi, $23,127; Wissahickon low-level, intercepting sewer, $28,620; Bingham St. extension, Lombardi & Pascuzzi, $13,840; Jackson St. extension, David Peoples, $36,121; Twelfth St., between Louden and Ruscomb Sts., Patrick Durkin, $8,020.20; Wissahickon high level extension, Edwin H. Vare, Betz Bldg., $47,839.60; Ninth St., Erie Ave. to Butler, R. P. Bennis, $24,495; reconstruction of Market St. sewer, Edwin H. Vare, $3,925; reconstruction of Pine St. sewer, Millard Construction Co, Pennsylvania Bldg., $25,000.

Swissvale, Pa.—Subway.—Green & Read, Construction Co., at about $100,000 for undergrade crossing at Braddock Ave., for P. R. R.

Wilkesbarre, Pa.—Paving.—F. Kemp & Son, paving Huston St.

Wilkesbarre, Pa.—Mining Shafts.—Fowler Bros., for 2 shafts for Lackawanna Coal Co.

Harrisburg, Pa.—Garbage Disposal.—Contract for collection and disposal of garbage, dead animals, etc., for a 10-year period, has been let to Carlisle & Martin, owners of Pennsylvania Ammonia & Fertilizer Co., Harrisburg. Contract price is $26,500 per year.

Harrisburg, Pa.—Road Work.—State Highway Department has awarded following contracts: Pine Township road, Fred Robinson, Meadville; East Allen Township road, Northampton County, Hain & Neff, Slatington; Somerset Township, two roads, J. E. Francis, Punxsutawney; Troy Township, two roads, G. H. Kelter, Bloomsburg.

Bon Air, Tenn.—Railroad Shops.—Brogan & Crimmins, Fayetteville, Tenn., for round house, machine shop and sand drying plant for N. C. & St. Ry.

El Paso, Tex.—Road Work.—Richard Caples, at about $72,723 for macadamizing road between East El Paso and Ysleta.

Morgantown, W. Va.—Bridges.—Canton

Bridge Co., Canton, O., for iron and steel bridge over Monongahela River for County Court; to cost about $100,000.

PROJECTED WORK.

Railroads.

Items Arranged Alphabetically by States.

Pine Bluff, Ark.—Location surveys are now said to be under way for the projected line of the Pine Bluff North & South R. R. Thomas A. Bell Construction Co., St. Louis, Mo., are the engineers.

Huntsville, Ala.—Charter of Nashville & Huntsville Ry. Co., organized in Nashville some months ago, has been amended, and the capital stock increased from $50,000 to $150,000. The route of the lines is also changed so as to include Eagleville, Lewisburg and Elkton, instead of Murfreesboro, Shelbyville and Fayetteville, as was intended. The road is to connect this place and Nashville.

Lemhi, Idaho.—Survey work is about completed and work will be commenced by Nov. 1, it is said, on the construction of a railroad in Lemhi County. Pittsburg & Gilmore R. R., W. A. McCutchen, President, People's Bldg., Pittsburg, Pa., is back of the project.

Wallace, Idaho.—Kootenai Log & Railroad Co., of Wallace, has been incorporated; capital stock is $100,000.

McAlester, Ind. T.—Advices from this place state that preliminary work has been completed and that construction will be commenced this fall on a 50-mile railroad from the McAlester coal district to the Arkansas River at Tamaha. Local coal producers are behind the project.

Cherryville, Kan.—It is announced that the St. Louis & San Francisco R. R., J. F. Hinckley, Chief Engineer, St. Louis, Mo., will shortly have work commenced on the construction of a branch line from Cherryville, via Independence to Coffeyville. The line would be about 30 miles long.

Lansing, Mich.—The Ontonagon Southern Ry. Co., a subsidiary company to the Wisconsin and Northern R. R., has been incorporated. This latter road is to run from Oshkosh, Wis., to Ontonagon in Michigan and already has 50 miles of track laid. Surveys are now under way in Iron County, Michigan, for the Ontonagon Southern. W. Cambier, Oshkosh, Wis., is Chief Engineer Wisconsin & Northern R. R.

Bamberg, S. C.—Steps are being taken for the construction of a railroad from Bamberg to Ehrhardt, 13 miles. H. J. Brabham, Bamberg, is interested.

Cleveland, Okla.—Wichita, Cleveland & Gulf Ry. Co., has been chartered and proposes to build a line from Wichita, via Cleveland to Port Arthur, Tex., 634 miles. David Ratner and J. C. Byers, Cleveland, Okla., are interested.

Lawton, Okla.—Amended charter has been granted St. Louis, Springfield & Oklahoma Western R. R. Company, capitalized at $3,750,000 and has headquarters at Lawton. It proposes to build a line from Lawton east and north to Salisaw, Ind. T., 250 miles. C. S. Stoker, Stigler, Ind. T., W. T. Douglas, Sulphur, Ind. T., and J. D. F. Jennings, Oklahoma City, Okla, are interested.

Shawnee, Okla.—Muskogee Railway & Navigation Co., capitalized at $1,500,000 has been incorporated and proposes to build a 55-mile line from Muskogee to a point on Fort Smith and Western R. R. Ira L. Reeves, Muskogee, Ind. T., and C. R. Dean, Shawnee, are interested.

Brockville, Ont.—The Canadian Northern Ry. is considering the building of a main line between Brockville and Ottawa, and the advisability of making Merrickville a junction point of the Brockville branch with the main line running into Ottawa. M. H. McLeod, Winnipeg, Man., is Chief Engineer.

Bakersville, Pa.—Rockwood & Bakersville R. R. Co. has been incorporated and proposes the construction of a line of railroad from Rockwood to Bakersville and then to Barronsdale, a distance of 25 miles. The road would tap some of the new coal fields to be developed in that section of Somerset County. Charles F. Hood, President of the Indian Creek R. R. Company, is President and S. M. Faust of Connellsville, Pa., is Chief Engineer.

Pittsburg, Pa.—Local advices state that work will be started soon on a 90-mile line which will give the New York Central & Hudson River R. R., direct entrance into Pittsburg. The line is to be an extension of the New York Central & Hudson River branch, which now extends to Arcadia and the southern part of Jefferson County, Pa. It will cross from Indiana county to Westmoreland county, which it will also cross, following the little Sewickley creek to the Youghiogheny river, near Sutterville, Pa. Here it will join the Pittsburg and Lake Erie railroad, a Vanderbilt interest, and from there it will run to Pittsburg. G. W. Kittredge, New York City, is Chief Engineer, N. Y. C. & H. R. R. R.

Stamford, Tex.—Final surveys are being made for the Stamford Northwestern R. R., which is to extend 100 miles in a northwest direction from this city.

Houston, Tex.—Missouri, Kansas & Texas Ry. Co. proposes to build a new yard at Eureka, 5 miles from here. About 4 miles of track will be laid.

Centerville, Tenn.—Grays Bend & Centerville R. R. Co., capitalized at $50,000, has been incorporated and proposes to build a railroad from Grays Bend to Centerville. Incorporators are: G. S. Anderson, R. H. Wilson, C. F. Frizzell, C. T. Boyd and C. N. Gilbert, of Nashville, Tenn.

Tyler, Tex.—Surveys are now in progress for the People's R. R., which it is proposed to build from Tyler to Canton, 30 miles. Megargel & Co., 5 Nassau St., New York City, are reported to be backing the project.

Dallis, Tex.—Union Central R. R. of Texas has been incorporated; capital stock is $225,000 and headquarters will be at Dallas. It is proposed to construct a line of railroad from Dallas through Kaufman, Henderson, Cherokee, Nacogdoches, Anderson, San Augustine and Sabine counties to Sabine River on the line of Louisiana, a distance of 225 miles. Among the incorporators are: W. J. Hogue, of Dallas; W. H. Marsh, of Tyler; T. B. Poindexter, of Wortham; J. B. Gordon, Fairfield; H. H. Hyde, Houston, and James A. Lucas, Edgewood.

Lubbock, Tex.—Residents in the Panhandle of Texas are projecting the construction of a road to be known as the Panhandle Short Line. As projected the route of the road will be over 200 miles long, extending from Hereford to Stanton. Dr. G. T. Veal and W. T. Wells, Roswell, N. Mex., are reported to be interested.

Temple, Tex.—Temple Commercial Club has appointed committee, of which A. F. Bentley is chairman, to consider steps for building railway between Temple and Abilene.

Bingham, Utah.—Bingham Central R. R. Co., recently incorporated with $500,000 capital, while formed to take over and control the Mascotte tunnel of the Ohio Copper Co., will, it is said, ultimately construct a railroad line from the mouth of the tunnel to the smelters in the Salt Lake Valley. A. C. Ellis, Jr., is President, and W. T. Gunter is Secretary.

Salt Lake City, Utah.—Southern Utah R. R. Co., capitalized at $100,000, has been incorporated, and proposes to build a road in Carbon County from the Independent coal mine to a connection with the Rio Grande near Price. The road will be 20 miles long. A. A. Sweet is President and H. I. Thomas Secretary.

Salt Lake City, Utah.—Arrangements are said to have been made with a syndicate of Utah capitalists, headed by Jesse Knight and United State Senator Reed Smoot, to build a line from Salt Lake to Vernal, Utah, to connect with the line which David H. Moffat is building west from Denver. It is given out that eventually this line may be extended to Los Angeles or San Francisco, via Goldfield or Tonopah, Nev.

Electric and Gas Plants.

Items Arranged Alphabetically by States.

Fort Smith, Ark.—The Fort Smith Light & Traction Co. is planning to spend $50,000 in improvements for the power house.

Stockton, Cal.—The Stockton Gas & Electric Co. has been incorporated by A. H. Winn, Paul McDonald and others.

Eaton, Colo.—The Eaton Electric Co. has been incorporated with a capital stock of $35,000, by W. J. Farr and Roscoe S. Farr.

Essex, Conn.—The plant of Essex Light & Power Co. has been purchased by George L. Cheney and Mrs. William G. Seeley of this place and William A. Frothwell of Chester.

Laurel, Del.—Local electric light plant reported destroyed by fire.

Columbus, Ga.—Election will be held Oct. 10 to vote on issuance of $100,000 of bonds for constructing municipal electric light plant.

Geneva, Ill.—The Geneva & Batavia Heat, Light & Power Co. has been incorporated by Charles J. O'Connor, W. Hamilton Gallagher and B. Harold O'Connor.

Hinsdale, Ill.—Hinsdale Electric Co., capitalized at $2,500, has been incorporated. Arthur W. Marrow is interested.

Manito, Ill.—Smith & Miller, of Bloomington, Ill., have been granted a 20-year franchise here for the purpose of operating an electric light plant.

Washington, Ind.—Plans are being made for the improvement and re-equipment of the municipal electric light plant.

Berrien Springs, Mich.—This place has voted to issue bonds for installing electric lights and water works.

Aurora, Minn.—The council is considering the installation of an electric lighting system.

Northome, Minn.—E. E. Bigham, of Minneapolis, was granted a franchise for electric light system here.

Hattiesburg, Miss.—A power station will be constructed here for the Hattiesburg Traction, Gas & Electric Light Co., to cost $175,000.

Gorin, Mo.—Tom Yeager will install an electric light plant at this place.

Exeter, Neb.—A franchise was granted to C. C. Smith for the construction of an electric light plant.

Marblehead, O.—The Marblehead Power Co. has been incorporated with a capital stock of $5,000 by H. T. Clark, C. T. Brooks, C. C. Owens and others.

Custer, Okla.—A. B. Hulit of Oklahoma City, has been granted a franchise to construct and operate an electric light and power plant here.

Lead, S. Dak.—The Montezuma Gold Mining Co., of Lead, contemplates erecting a hydro-electric plant on Rapid Creek. L. D. Ballor of Lead is the secretary of the company.

Palestine, Tex.—W. B. Johnson and George R. Cooke will erect an electric light plant and power plant in this city.

Tacoma, Wash.—Aztec Power Co., capitalized at $25,000, has been incorporated. A. R. Warren is interested.

Elkins, W. Va.—Elkins Power Co. has been incorporated with a capital stock of $75,000 by Stephen B. Elkins, J. T. Davis, N. I. Hall and others.

Amherst, Va.—A corporation will be soon organized with the object of furnishing electric light to the town of Amherst. The site has already been purchased for the erection of the plant. Messrs. H. L. and H. E. Page, of Norfolk, are ineresed.

Richford, Vt.—This place proposes to rebuild its power plant, damaged by fire last August. Proposed cost is $35,000.

Boydton, Va.—Mr. R. W. Lassiter, of Oxford, N. C., is negotiating with owners of lands on the Roanoke River with a view of securing the water rights on the river for the purpose of establishing an electric plant at Eagle Point Falls.

Sewers.

Items Arranged Alphabetically by States.

Blytheville, Ark.—Committee, A. C. Lange, Chairman, has been appointed to secure engineer to report on feasibility of installing sewerage and water system.

Oakland, Cal.—C. D. Vincent, at $41,383, was low bidder Sept. 18, for constructing Wood St. intercepting sewer.

Santa Monica, Cal.—Council will call special election to vote on issuing $150,000 of bonds for sewer system and $100,000 for garbage incinerator.

Wallace, Idaho.—Special election will be held to vote on issuing $16,000 of bonds for constructing sewers.

Elgin, Ill.—Ordinances are being prepared for sewers in Walnut Ave. and Watch St. C. E. Plum is City Engineer.

Herrin, Ill.—W. T. Pierce, Engineer, has reported on proposed sewer system for this place. Estimated cost is set at $39,803 and includes the following: Cost of pipe, $10,279; earthwork, $25,320; manholes, $2,680; tees, $254; flush tanks, $1,000; incidentals, $270; total estimated cost, $39,803.

St. Charles, Ill.—Plans and estimates for Main St. sewer district have been completed and are now before the Council.

Riverside, Ind.—Town Council has adopted specifications for construction of Jersey St. sewer. Estimated cost is $1,800.

Vincennes, Ind.—Board of Works has been considering plans for a sewer system. Jos. V. Hershey is City Civil Engineer.

New Orleans, La.—Sewerage and Water Board, F. S. Shields, Secy., has rejected the bids received Sept. 11, for construction of about 110 miles of sewers. The bids were about $300,000 above the estimated cost of the work.

Gladwin, Mich.—Construction of sewer in Bowery Ave. is proposed. Estimated cost is $1,170. George W. Doane is City Engineer.

Tecumseh, Mich.—A $20,000 bond issue for sewers has been voted.

Richmond, Mo.—W. Kiersted, Consulting Engineer, has made report on sewer system for this place.

St. Paul, Minn.—According to revised plans the projected Warrendale sewer system will cost about $28,000.

Plainfield, N. J.—Borough Council is taking steps for sanitary sewage disposal system.

Auburn, N. Y.—Board of Estimates has approved purchase of site for city sewage disposal plant.

Youngstown, O.—Resolutions are before Council for sewering Shehy St., Rigby St., Duquesse St., and West Woodland Ave.

Capital Hill, Okla.—This place has voted on the issuing of $90,000 of bonds for installing sewerage and water system. H. O. Schilling is Mayor.

Oklahoma City, Okla.—Sewer on Blackwelder Ave., will be rebuilt at a cost of about $25,000. A bond issue for $200,000 for extending sewer system has been voted.

Chester, Pa.—Construction of 5 ft. sewer on Jeffrey St. is proposed.

Erie, Pa.—Ordinances have been passed for construction of sewers in a number of streets.

Harrisburg, Pa.—Ordinances will come before Council for constructing sewers to cost $5,000.

Scranton, Pa.—Council has passed ordinances for constructing sewers in Plum and 21st, 22nd and 23rd Sts.

Wilkesbarre, Pa.—Tentative plans for a sewer to avert floods in North Pennsylvania Ave. and adjacent streets are under consideration. Sewer would cost about $100,000.

Williamsport, Pa.—Contract for construction of Grafius Run sewer from Laurel St. east, will be let shortly.

Center, Tex.—County Commissioners will put in sewer system at Court House.

Denton, Tex.—Application has been made for franchise for sewer system here.

Waukesha, Wis.—City is considering installing new sewer system to cost $26,000.

Water Supply.

Items Arranged Alphabetically by States.

Columbia, Ala.—Water works and electric light plant projected. T. Gordon is interested.

Tucson, Ariz.—Plans, etc., are being prepared for improvement of city water works. Tom Conlin is Superintendent.

Chico, Cal.—Diamond Match Co. will install large fire protection system.

Lordsburg, Cal.—Advices from this place state that pumping plant of La Verne Land and Water Co. at La Verne has been destroyed by fire.

Greeley, Colo.—B. D. Sanborn has submitted plans to contractors for outlet gates and towers and 300 foot tunnel for Boyd's Lake, two miles northwest of Loveland, Colo.

Ashburn, Ga.—Election will be held to vote on issuing $45,000 of bonds for water works and electric light plant.

Covington, Ga.—Election is to be held Oct. 9 to vote on $55 000 bond issue for constructing water works and sewers.

Millen, Ga.—Election was held Sept. 16 to vote on issuing $30,000 of bonds for water works and electric light plant.

Seneca, Ga.—Water works and electric light plant are under consideration.

Silvis, Ill.—Plans are being considered for installing water works and sewers here.

South Bend, Ind.—Board Public Works is obtaining figures on the cost of building, pumps, engine, boilers and necessary machinery, with the estimates on construction of buildings and installation of machinery for a new pumping station.

Ardmore, Ind. T.—Election will be held Sept. 24, and issuing of $30,000 of water bonds will be voted on.

Weleetka, Ind. T.—Weleetka Light & Power Co., D. F. Campbell, Manager, contemplates making improvements to water works system.

Waterloo, Ia.—Illinois Central Railroad may install new water plant here.

Nampa, Idaho.—A $7,000 bond issue has been voted for changing pumping plant, so that it can be operated by electricity.

East Moline, Ill.—City will purchase land on which to establish water works plant.

Lawrence, Kan.—Lawrence Water Co. will enlarge its plant.

Berlin, Md.—Mayor and City Council will grant a franchise and receive propositions to furnish water and electric lights for the town.

Limerick, Me.—Limerick Water & Electric Co. has been incorporated; capital stock is $500,000 and J. F. Moore, Newfield, Me., is President.

Paw Paw, Mich.—A $50,000 bond issue has been voted for installing water works and electric light plant.

Escanaba, Mich.—Escanaba Water Co. will erect filter plant.

Milan, Mich.—A $3,000 bond issue has been voted for installing water works and sewers.

Meridian, Miss.—Election will be held September 27 to vote on issuing $50,000 of bonds for extending water mains.

Aurora, Mo.—City has taken steps toward acquiring municipal water works.

Shelbina, Mo.—Water works and sewers may be installed here.

Hildreth, Neb.—A $10,000 bond issue for installing water works has been voted.

McCook, Neb.—Pumping plant of local water works is reported as destroyed by fire.

Ventnor (P. O. Atlantic City), N. J.—City is considering purchase of plant of Ventnor Water Co. and improvement of it.

Ridgeway, Pa.—State Health Department has condemned local water supply and requires new one with filter plant.

Tarentum, Pa.—Permit has been granted by State Health Department for this place to erect filter plant.

New Cumberland, Pa.—Riverton Consolidated Water Co. proposes to build $50,000 reservoir in York Mountains and to supply Riverton, LeMoyne and Camp Hill by gravity system.

Harrisburg, Pa.—State Water Supply Commission has approved charters of following companies: Blue Water Co., to supply North Bellevernan; capital, $5,000. M. Allen, Uniontown. Bright Run Water Co., Fracksville, to supply Butler Township, Schuylkill County, $10,000. A. N. Wetherlee, Philadelphia. Furnace Water Co., to supply Josephine, Indiana County, $5,000. J. E. Ferris, Cleveland. Mountain Gap Water Co. to supply Spring Township, Centre County, $10,000. H. J. Jackson, Bellefonte. Red Water Co., to supply Washington Township, Fayette County, $5,000. M. Allen, Uniontown. The Tatamy Water Co., to supply Tatamy, Northampton County, $5,000. G. S. Messinger. Waterford Water Co., to supply Waterford Borough, Erie County, $10,000. C. Himrod. Yellow Water Co., to supply Rostraver Township, Westmoreland County, $5,000. M. Allen, Uniontown.

Gregory, S. D.—Municipal water works is to be installed here.

Sweetwater, Tenn.—A $30,000 bond issue for water works has been voted.

Crockett, Tex.—Election will be held October 15 to vote on issuing $25,000 of bonds for water works.

Dickson, Tenn.—City has voted $25,000 bond issue for providing water works.

Sweetwater, Tenn.—A $30,000 bond issue has been voted for water works.

Amarillo, Tex.—Special election may be held to vote on $80,000 bond issue to purchase present water works or to build new system.

Beaumont, Tex.—Beaumont Water Works Co. will make extensions and improve its plant.

Brownsville, Tex.—A $70,000 bond issue for water works and electric light plant has been approved.

Swanton, Vt.—A $75,000 bond issue for installing new water system has been voted.

Mabton, Wash.—Work on the new water system will begin within the next month. L. Lee of Olympia, Wash., Engineer. National Woodpipe Co., is preparing plans and specifications.

Madison, Wis.—Work will soon be started on a new 1,000,000 gallon reservoir for a municipal water works here.

Union, W. Va.—Bonds for $5,500 for constructing water works will be sold Oct. 5. A. S. Johnston is Mayor.

Wheeling, W. Va.—Board of Public Service is planning the extension of water mains here.

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WATER-WORKS.

Marion, Kansas.

Sealed bids will be received by the City Clerk of Marion, Kansas, up to three (3) o'clock p. m., of Tuesday, the 22d day of October, 1907, for water works construction, separate proposals being entertained as follows:

1. For furnishing cast iron pipe and special castings. Certified check, five hundred (500) dollars.
2. For furnishing hydrants and valves. Certified check, one hundred (100) dollars.
3. For furnishing and installing machinery, laying pipe, constructing well, power house, tower foundations, etc. Certified check, five hundred ($500) dollars.

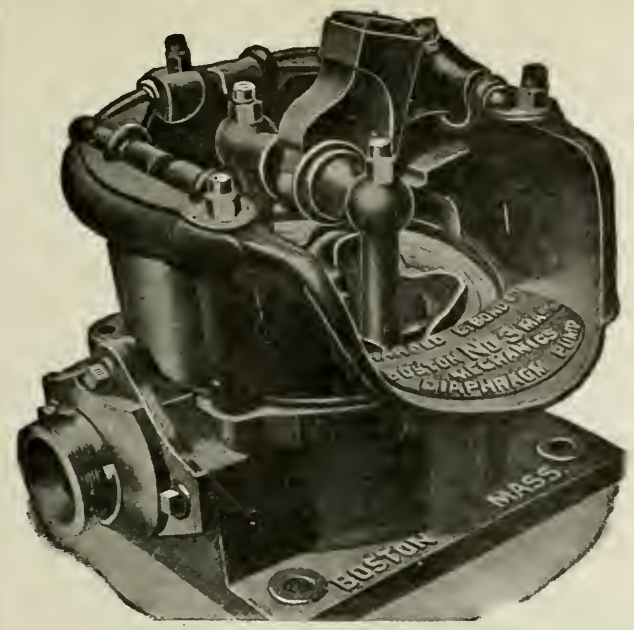
Plans and specifications on file at the office of City Clerk and at the office of the Engineers, 823 Scarritt Building, Kansas City, Missouri.

Ample opportunity will be given for all bidders to consult plans on file, but anyone desiring extra copies for his own use may obtain the same from the Engineers by payment of five (5) dollars to cover the cost of same.

The City reserves the right to reject any and all bids.

A. S. QUINSBERRY, Mayor.
THOS. W. BOWN, City Clerk.
BURNS & McDONNELL, Engineers,
821-22-23 Scarritt Building,
14-1t Kansas City, Missouri.

STEEL BRIDGES—Department of the Interior, U. S. Reclamation Service, Washington, D. C., Sept. 18, 1907—Sealed proposals will be received at the office of the U. S. Reclamation Service, Glendive, Mont., until 2 o'clock p. m., November 15, 1907, for the construction and erection of 34 steel highway bridges in connection with the lower Yellowstone project, North Dakota-Montana. For particulars address U. S. Reclamation Service, Washington, D. C., Huntley, Mont., or Glendive, Mont. G. W. WOODRUFF, Acting Secretary.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WATER-WORKS PLANT.

Newton, Miss.

Bids will be received by the Mayor and Board of Aldermen until 2 p. m., Oct. 7th, 1907, for material and construction of complete water-works system. Plans and specifications can be seen at the Mayor's office after Sept. 23d, or apply to the engineer, Xavier A. Kramer, Magnolia, Miss.

XAVIER A. KRAMER.

COMPETITION FOR PLANS FOR THE CAPITOL OF PORTO RICO.

San Juan, Porto Rico.

By Act of the Legislative Assembly of Porto Rico, dated March 14th, 1907, the Commissioner of the Interior is authorized to announce a competition for a building to be known as the "Capitol of Porto Rico," the cost of such building not to exceed $300,000.00.

Architects who wish to enter this competition must signify their intention in writing to the Commissioner of the Interior on or before November 1st, 1907. Drawings will be received from no others.

The competitive designs must be received on or before February 1st, 1908.

Copies of the program, embracing terms of the competition will be mailed upon request.

L. H. GRAHAME,
Commissioner of the Interior.

PROPOSALS FOR WATER PIPE.

Office of the Superintendent of the Water Department of the City of Phoenix, Ariz., September 25, 1907.

Separate bids will be received by the Superintendent of the Water Works of the City of Phoenix, Arizona, at the office of the said Superintendent, up until 3:30 p. m., of November 15, 1907, for the following:

1. Furnishing all material and labor for the completion of contemplated improvements.
2. Supplying material only.
3. Necessary work for the installation of the same.

Specifications can be obtained, upon application, from the Superintendent, at City Hall, Phoenix, Arizona.

A certified check for five per cent of the amount of the bid, made payable to Frank Thomas, Recorder for the City of Phoenix, is to accompany each proposal, to be held as a guarantee that a contract with bond approved by him will be entered into by the party whose bid is accepted, in accordance with the terms of the said bid.

The Superintendent reserves the right to reject any or all bids, in whole or in part.

ROBT. CRAIG,
14-1t Superintendent.

SEWERS.

Chattanooga, Tennessee.

Sealed proposals, directed to the Board of Public Works, and endorsed "Bid for building Chestnut Street Sewer," will be received at the office of the Board until 2:30 p. m., October 15th, 1907, for the construction of a brick Main Sewer and appurtenances on Chestnut Street from Tennessee River to the center of Ninth St. The dimensions and length of the sewer will be as follows:

36"x54"	Egg-shaped sewer	465.8 feet
38"x57"	Egg-shaped sewer	465.9 feet
42"x63"	Egg-shaped sewer	468.5 feet
46"x69"	Egg-shaped sewer	466.4 feet
50"x75"	Egg-shaped sewer	2,032.5 feet
60"	Circular sewer	175.0 feet
Total		4,074.1 feet

On depositing with the Clerk of the Board the sum of $5 there will be furnished blank form for proposeal, contract and bond, with blue-print plans and profiles, on the return of which the money will be refunded, provided a bid in regular form is received from the depositor. A certified check for $5,000, payable to T. J. Gillespie, City Treasurer, must accompany each bid. A corporate bond, to be approved by the Board, of not less than one-half the amount of the bid, and conditioned as the law requires, will be required of the successful bidder.

The right is reserved to reject any or all bids.

By order Board Public Works.

H. F. Van DUSEN,
Chairman.

DEPARTMENT OF THE INTERIOR, United States Reclamation Service. Washington, D. C., Sept. 20, 1907—Sealed proposals will be received at the office of the United States Reclamation Service, 876 Federal Building, Chicago, Illinois, until 2 o'clock p. m., October 21, 1907, for furnishing 12,000 barrels of Portland cement, f. o. b. cars at the works of the bidder. For particulars address the U. S. Reclamation Service, Washington, D. C., or Chicago, Illinois. G. W. WOODRUFF, Acting Secretary. 14-2t

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NOTICE TO BRIDGE CONTRACTORS FOR BIDS.

Sealed bids will be received by the Board of County Commissioners of Neosho County, Kansas, at the office of the county clerk of said county, up to 12 o'clock on Tuesday, October the 15th, 1907, for the construction and erection of three all steel or iron bridges, to be erected across the Neosho river, in Neosho County, Kansas, to be as follows:

One 200 foot span, one 70 foot span, two 30 foot I-beam approaches, 20 foot roadway, 4 54-inch tublers 40 feet high, two 36-inch tublers 25 feet high, concrete abutments for approaches; said bridge located one mile east of Chanute, Kansas.

One 200 foot span, one 75 foot span, one 30 foot I-beam approach, 14 foot roadway, 4 48-inch tublers 38 feet high, concrete abutments for approaches; said bridge located 2½ miles west of Erie, Kansas.

One 200 foot span, one 50 foot span, one 30 foot I-beam approach, 14 foot roadway, 4 48-inch tublers 39 feet high, concrete abutments for approaches; said bridge located one mile south of St. Paul, Kansas.

Also repair of one bridge on Flat Rock Creek, 5 miles east of Kimball, Kansas.

Also one 30 foot I-beam for bridge 7 miles southeast of Thayer, Kansas.

All bidders must deposit a certified check of one hundred dollars, with bid which will be forfeited by the successful bidder if he fails to contract and furnish bond required within ten days.

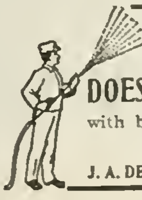
The board reserves the right to reject any or all bids.

All plans and specifications on file in the office of the county clerk, at Erie, Neosho County, Kansas.

Dated at Erie, Kansas, September 4, 1907.

H. LODGE, Chairman.

Attest: O. M. JOHNSON,
(Seal) County Clerk.



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WANTED—Names of abrasive manufacturers who use garnets. A. C. Seward, 6 The Dunbar, Toledo, O.

WANTED—Catalogs and other information concerning the construction of lime kilns, especially those having steel shells and built to use crude oil fuel. N. C. Ray, Merced, Cal.

WANTED — Drawings, Maps, Lettering, Plats, Tracings to make, by experienced draftsman. 421 North Blackford St., Indianapolis, Ind.

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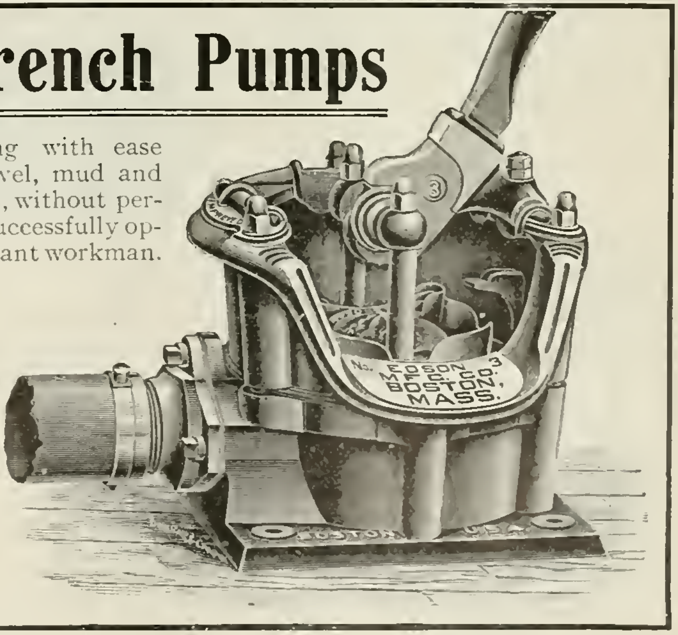

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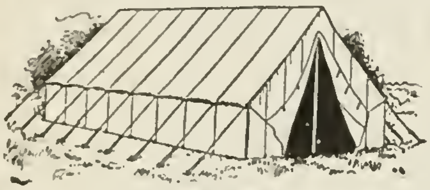

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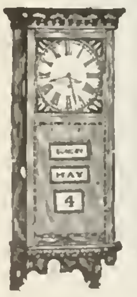

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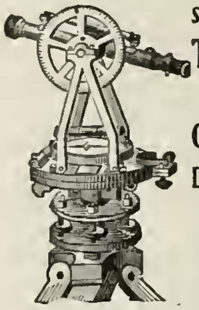

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Suggestions for Back Filling Trenches.

On another page of this issue we print a paper by Mr. George C. Warren on back filling trenches in city streets. Mr. Warren is correct in his criticism of the manner of doing this work, and thousands of dollars of valuable pavements have been ruined by the settlement of earth in trenches, when a few dollars spent in compacting the material in the trench, would have prevented this waste.

To remedy this evil Mr. Warren suggests paying for trench work on the basis of the number of units of work done, rather than on a unit of a lineal foot of pipe work and trench together. This suggestion is to be commended. Better work is always obtained and economical prices secured by letting work by units of each class of work, rather than by lumping together a number of different kinds of work, and letting it for a lump sum, whether this lump sum is for the entire job, or for a section or unit of the completed work.

Why should the cost of materials, the digging of earth and rock, shoring, pipe laying and numerous other kinds of work be paid for under one head, when each can be paid for separately, and only the amount of each material used or each unit of work actual done be paid for? Such a method is far more flexible in that it permits a modification of the plans or methods to suit the conditions encountered. Moreover, it results in fairer contract prices.

Contractors Should Be Protected Against Debts Contracted for Employees.

Mr. F. H. Newell, director of the Reclamation Service, in his report has the following to say regarding laborers working for his department:

"One of the most serious and complex problems with which the engineers have had to deal has been that of labor. As a rule the pay roll on the Gunnison project contain 800 or 900 names a month, while the number of men actually employed at one time probably does not exceed 450. This condition has confronted the contractors as well as the engineers who are directing the work carried on by force account. The contractors have been obliged to ship most of the laborers from the large centers and in many cases the men do not work long enough to repay the money advanced for their transportation expenses."

One of the greatest troubles that contractors have with laborers is that mention in the last part of the paragraph, the "skipping of transportion," as it is termed in camps. In carrying on heavy construction work in the country it is never possible to obtain enough laborers from the local sources, and, even where it is possible to get a large number of men, they are usually not accustomed to the work, and a large per cent will not stay on the job long enough to learn and become endured to the work.

Consequently the contractors must go to the laboring centers and carry men from them to their various jobs. The contractor must ordinarily pay agents to collect the men for him. In some cases, in order to carry men from one state to another he must pay a license. Then the men must be fed on the trip, their transportation charges paid, and after arriving at the work the laborer must be furnished bedding, often shoes and clothing to fit him for work, and must be given food while he works and pays the debts he has contracted.

For any board furnished the man, he can be legally held, but, for the other money spent on him, the contractor has no means of recovering, except by keeping close watch on him. Contractors, throughout the country, annually lose thousands of dollars through the desertion of men whose transportation they have paid. If contractors attempt to hold the men by guarding them, and thus prevent them from "skipping their transportation" they are liable to be arrested for peonage.

This is a condition that exists on much government work, as well as on private contracts, and as most men are taken from one state to another, it has become an interstate matter. It is a subject for Congress to handle and make such laws that will protect both the contractor and the laborer. Now that Director Newell has called attention to the subject it would seem an opportune time to better these conditions. This is one of the many subjects that the American Society of Engineering-Contractors will have to consider.

The First Great Engineer.

Engineering is the science that transmutes the luxuries of yesterday into the necessities of to-day. The greatest agent in this transmutation is the railway. Hence the first great engineer must have been the man who made the railway possible. That prehistoric fellow who cut two discs from a log and fitted an axle through their centers was entitled to the basic patent on mechanical locomotion. He was the first great engineer. Others have fashioned flanges upon the wheels and have provided rails for them to roll upon, but they might almost be called doers of the obvious thing The thing that was not obvious was the wheel. Still others have added pneumatic tires and ball bearings to wheels, but the rolling disc and axle constitute the original entity, to which the rest are mere plusses. Were a patent on the wheel in force to-day, the royalty that its owner could exact would dwarf all existing standards of giant wealth. Before the invention of the wheel, burdens were carried on the backs of beasts and men, and every step that was taken involved lifting the burden against the force of gravity. A walking animal moves on levers. The front leg serves as a lever, with its fulcrum on the ground, supporting a load in the air, while the rear leg is the power shoving upward against the load. The front leg revolves into a vertical position, and then begins to fall forward. There is a repeated rising and falling of the whole body of a walking creature. A man's body rises about one and seven-tenths of an inch, or one-seventh of a foot, every step he takes. A

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hundred steps in a minute carry him forward only two hundred and sixty feet. If he weighs one hundred and fifty pounds, his body is lifted one hundred times a distance of one-seventh of a foot each time, so that he lifts his own weight fourteen feet vertically, and therefore does 2,100 foot-pounds of work in the minute, merely in overcoming gravity. This same energy expended by a motor rolling on rails would transport the 150-pound man at least twelve times as far as he transports himself when walking. Such is the crudity of the walking machine.

What line of thought led the first great engineer to make his wonderful invention of the wheel? Did he start by observing the ease with which a fallen log, or a round stone, can be rolled along? And when he had fashioned his first rough wagon, was he cursed by the labor unions of his day? Did they not argue that wheels were sure to displace legs, and thus put the owners of the legs out of a job as burden carriers? Did they not protest against the wheel, and, perhaps, persecute its inventor? Does this thought seem fantastic? Listen. In the year 1601, because the boatmen on English rivers were suffering from a falling off in their business, a bill was presented in Parliament "to restrain the excessive use of coaches." One Taylor, a gondolier poet of the Thames, wrote four lines, which should be framed and hung in every hall where labor unions meet:

"Carroaches, coaches, jades and Flanders mares
Doe rob us of our shares, our wares, our fares.
Against the ground we stand and knock our heels
Whilst all our profit runs away on wheels."

The total expenditures for public roads in the United States in 1904 amounted to $79,771,418.

The national advisory board on fuels and structural materials, which is co-operating with the technologic branch of the U. S. Geological Survey, will hold its annual meeting at the Jamestown Exposition Oct 25 and 26. This board will examine and review the operations of the various testing plants of the technologic branch for the past year and will outline the tests of fuels and structural materials for the ensuing year

---

According to a report from the U. S. Consul at Kingston, Ont., there is a heavy drop in prices of second-grade horses in the Canadian horse market. The cheaper grade of horses has seriously depreciated in value. Good horses are in demand and bring good prices, but second-grade horses are down in price. Horses that sold for $100 to $125 last spring are now selling for $50 and $60 each.

Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

A Coffer Dam Built of Reinforced Concrete.

In a discussion on foundations at the last annual meeting of the American Society of Civil Engineers Mr. C. M. Morssen gave a brief description and some cuts of a reinforced concrete coffer dam used for a bridge abutment in Austria.

A coffer-dam, 30 by 12 ft. in section, and 15 ft. high, was built above the ground, in which it was to settle down. The water was taken out by a centrifugal pump, which removed 2 cu. yd. per min. This pump was driven by an electric motor erected on top of the coffer-dam. The dam was lowered by excavating inside of it, the vibration of the motor in the coffer-dam proving of great assistance in working it down. The advantages of this system are:

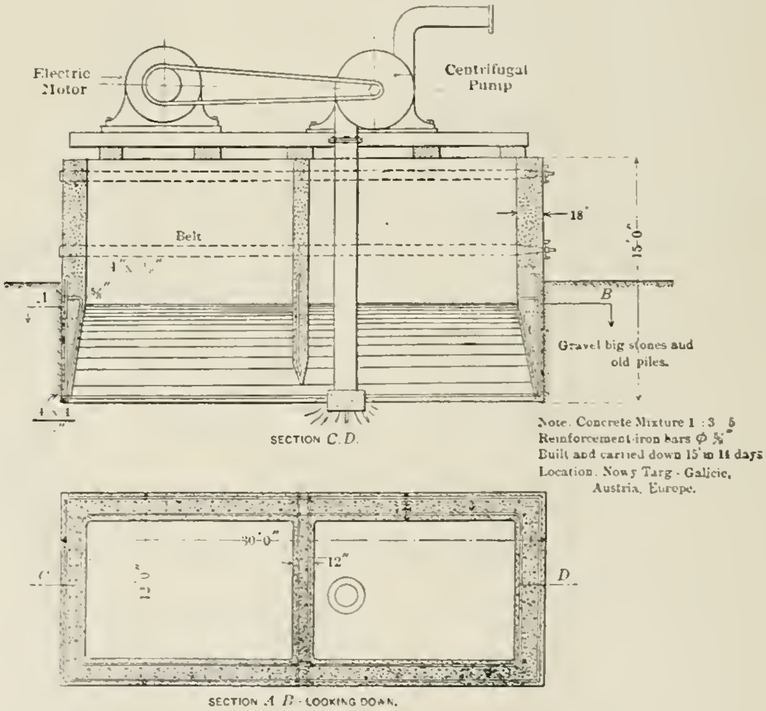
(1) A coffer-dam of the proper dimensions and of the same height as the depth to which it is to be sunk, can generally be built above the ground. The motor, pump, and suction pipe being fixed on top of the structure, and the suction pipe being of a definite length, the work may be carried on steadily, as no cessation is necessary from time to time to lengthen the pipe, as is the case with other systems.

(2) Absolute safety for the workmen.

(3) The motor's vibrations, combined with the great weight of the coffer dam, ensure a regular settling of the dam.

(4) The walls of the coffer-dam, being re-enforced, act as very strong beams, and when big stones, wooden timbers, or pipes, are encountered, an aperture can be made under the wall of the dam without injuring it, thus permitting the removal of the obstruction. After the dam has been sunk to the required depth it is filled with concrete and thus forms a very solid foundation.

The general arrangements are shown in the accompanying cut.


Electric Motor
Centrifugal Pump
Belt
18"
15'-0"
4" x ½"
⅝"
A
B
4 x 4
Gravel big stones and old piles.
SECTION C.D.
Note. Concrete Mixture 1 : 3 : 5
Reinforcement-iron bars ϕ ⅝"
Built and carried down 15' in 14 days
Location. Nowy Targ - Galicie, Austria, Europe.
30'-0"
12"
12'
C
D
SECTION A B - LOOKING DOWN.

Reinforced Concrete Coffer Dam Built to Carry the Middle Pier of a Reinforced Concrete Bridge.

The Ministerio de Fomento, Madrid, Spain, is asking tenders for the construction of the Algeciras Harbor Works, estimated to cost over $2,000,000.

Methods and Cost of Erecting a 6-Story Reinforced Concrete Building.

In this article we shall give the cost of labor and materials required to erect a six-story building of reinforced concrete. The costs cover the concrete only, and do not include the cost of the walls, which were of brick, nor of the partitions, which were of tile.

The building was 91 x 112 ft., and each floor was supported by 56 reinforced concrete columns squared and 9 ft. high. The columns were spaced 16 ft. c. to c., as shown in Fig. 1, and supported beams 10 x 10 ins., with an intermediate beam 5 x 10 ins.

Forms. Figure 2 is a horizontal cross-section of one of the forms for a column. The boards are of 1½-in. stuff surfaced on one side. The four boards are held together by yokes, spaced 2 ft. apart. Each yoke consists of a pair of 2 x 4's, held together by two ½-in. rods and two 1 x 6-in. pieces directly over these rods. These 1 x 6-in. pieces are nailed to the 2 x 4's, with 8d nails, the heads of which are left projecting so that they can be easily pulled out when the forms are to be stripped from the concrete columns.

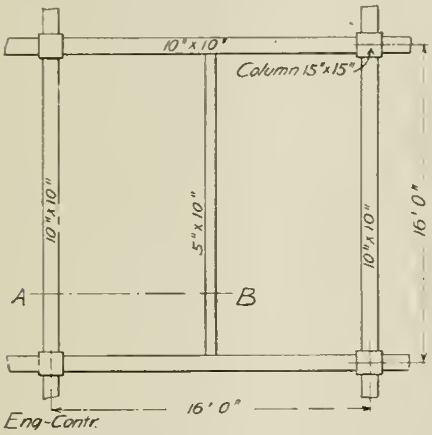


Fig. 1—Sketch Showing Spacing of Columns and Girders.

Resting on these column forms are the forms for the concrete beams, shown in Fig. 3, which is a cross-section through Fig. 1, on the line A B. Half way between the column forms, each beam form is supported by a 3 x 4 post, on the top of which is nailed a head block (4 x 4 x 12 ins.), and the bottom of which rests on a wedge. The wedge is knocked out when the forms are to be removed. The planks used in the forms for the beams are of 1½-in. stuff surfaced on one side, and the bottom plank is screwed (not nailed) to the two side planks with ⅜ x 4-in. lag screws spaced 28 ins. apart. To the side planks are nailed 1 x 4-in. cleats which support the ends of the 3 x 4-in. stringers, which, in turn, support the 1 x 6-in. floor. The stringers are 28 ins. c. to c., and the floor planks are not nailed to them, neither are the stringers nailed to anything. It will be seen, therefore, that these forms are quickly taken apart, and with very little injury to the lumber.

The lumber required for one floor 91 x 112 ft., or 10,200 sq. ft. of floor area, is as follows:

	Ft. B. M.
Lumber for columns	9,000
Lumber for 10 x 10-in. beams	7,000
Lumber for 5 x 10-in. beams	2,700
Intermediate 3 x 4-in. posts	1,000
Lumber for floor (1 x 6-in. stuff)	9,000
Lumber for stringers (3 x 4-in.)	4,500
Total	33,800

In round numbers this is 35,000 ft. B. M. for 10,000 sq. ft. of floor area, or 3.5 ft. B. M. per sq. ft.

For this six-story building enough forms were provided to erect two complete floors. Then the forms on the lower floor were removed and carried up above the next floor and erected again. Thus the lumber was used three times, and it was still in good condition for further work.

With carpenters at $3.50 for 8 hours, the forms were framed ready for erection at $4 per 1,000 ft. B. M., due to the simplicity of the design, but this did not include the cost of erecting the forms. The lumber framed ready to erect cost:

	Per M.
Lumber	$26.00
Labor of framing	4.00
Total	$30.00

Since the lumber was used three times, we have $30 ÷ 3 = $10, to charge against each thousand feet board measure needed to encase the concrete on a floor. We have seen that there were nearly 34,000 ft. B. M. per floor, hence the cost for lumber ready for erection was $340 per floor. There were, as we shall see presently, 200 cu. yds. of concrete per floor (including columns, etc.), hence the cost was $340 ÷ 200 = $1.70 per cu. yd. for lumber.

It took a gang of five laborers seven days to tear down and carry up the forms for the next floor, at $2 per day, or $70 per floor, which is practically $2 per 1,000 ft. B. M. handled, or $0.35 per cu. yd. of concrete.

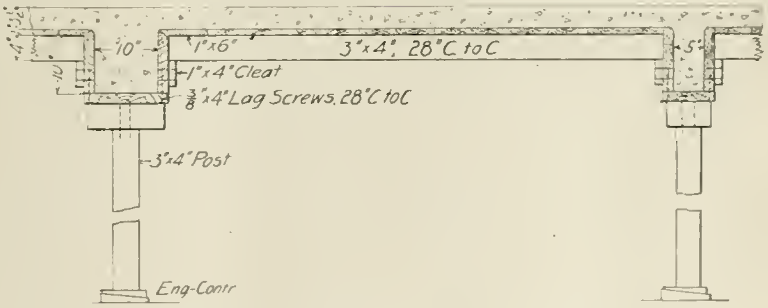


Fig. 3—Cross Section on A B, Showing Floor Form Construction.

It took a gang of ten carpenters seven days to erect these forms, which, at $3.50 per day, is $245 per floor, or $7 per 1,000 ft. B. M. handled, or $1.20 per cu. yd. of concrete.

Concrete Quantities.—The concrete floor slabs were 3½ ins. thick, and the floor area was 10,200 sq. ft. per floor. The size of the beams and columns has already been given. In round numbers the yardage of concrete per floor was as follows:

	Cu. yds.
Floor, 3½ ins. thick	110
Beams, 10 x 10 ins.	40
Beams, 5 x 10 ins.	20
Columns, 15 x 15 ins. (average)	30
Total per floor	200

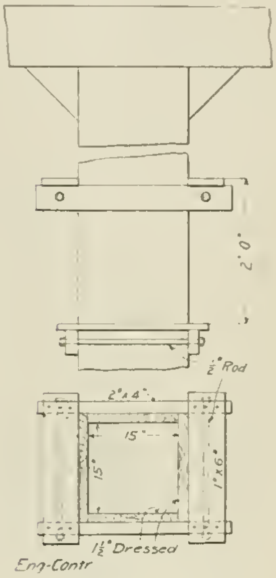


Fig. 2—Details of Column Form.

A concrete mixer, a hoist, and a gang of fourteen men mixed and placed the concrete (200 cu. yds.) in seven days, which, at $2 per day for laborers, is a trifle more than $1 per cu. yd.

Steel Quantities.—In each of the 10 x 10-in. beams there are four 1-in. round rods, two straight and two bent; and stirrups, ⅛ x 1-in., spaced 5 ins. apart at the ends of the columns and 15 ins. at the center. In each 5 x 10-in. beam there is half as much steel as in a 10 x 10-in. beam. The 3½-in. floor slabs are reinforced with ¼-in. rods, spaced 5 ins. apart, and two cross rods in 7-ft. panel. There are four rods in each column, averaging 1 in. in diameter each; heavier rods being used on the lower floors and lighter rods on the upper floors. In round numbers the steel required for each floor was as follows:

	Pounds.
Steel rods in 10 x 10-in. beams	16,200
Steel rods in 5 x 10-in. beams	4,000
Steel stirrups in beams	3,000
Steel rods in floor slabs	3,800
Steel rods in columns	1,400
Total per floor	28,400

This is equivalent to 142 lbs. of steel per cu. yd. of concrete, or about 1 per cent of the total volume of reinforced concrete is steel. The steel in the beams was about 3 per cent.

That enough steel was used is shown by the fact that a test load of 450 lbs. per sq. ft. was safely borne by the floor.

It required a gang of five laborers seven days, at $2.25 a day, to bend and place the steel for each floor, or $86 labor on 28,400 lbs. of steel. This is equivalent to 0.3 ct. per lb., or 45 cts per cu. yd. of concrete.

Summary of Cost.—Summarizing we have the following cost per cubic yard of concrete in the columns and floors of this building:

	Per cu. yd.
142 lbs. steel at 2½ cts	$ 3.55
1 bbl. cement	2.50
1 cu. yd. gravel	1.10
½ cu. yd. sand	0.55
170 ft. B. M. lumber ready to erect at $10 (1/3 of $30)	1.70
170 ft. B. M. torn down at $2	0.35
170 ft. B. M. erected by carpenters at $7	1.20
Mixing and placing concrete	1.00
Shaping and placing steel	0.45
Superintendence	0.25
Total	$12.65

It will be noted that the cost of the steel forms a very large percentage of the total cost. Had concrete side walls been erected, the amount of steel per cubic yard would have been considerably reduced.

A word of explanation with regard to the item of lumber is desirable, due to the danger of confusion that arises from the fact that the lumber was used three times. If the lumber had been used only once, it would have required 170 ft. B. M. per cu. yd. of concrete, at $30 per M. But, since it was used three times, we have called it 170 ft. B. M. at $10 per M. Another way of treating the problem is to divide the 170 ft. B. M. by 3, giving 57 ft. B. M., which is the actual quantity of lumber per cubic yard, and which multiplied by $30, gives the same $1.70 per cu. yd. We prefer not to summarize the result in this latter manner, due to the fact that it is always advisable to record the cost of the labor of taking down and erecting the forms in terms of the thousand feet board measure handled. Now, on this work, there were 170 ft. B. M. handled for every cubic yard of concrete, and it cost $9 per M. to handle it ($2 to take it down plus $7 to put it up again).

It is more consistent, therefore, to record the number of feet B. M. handled per cubic yard of concrete and to multiply this number of feet by the cost per M. of lumber divided by the number of times it was used.

It is also desirable to keep the cost of framing the lumber separate from the cost of erecting it; for the framing is done only once, whereas the erecting of the lumber occurs several times—three in this case. The low cost of framing is due to the simplicity of the design, and to the fact that no large panels were made. The forms were taken entirely apart each time they were moved, which greatly facilitated moving them. Moreover, no attempt was made to secure absolutely water-tight forms. The leakage of mortar is so slight as to be inappreciable, even in forms that show light through the cracks. There is a great deal of money uselessly expended in most form work, in planing the boards, and puttying up cracks so as to secure water-tight joints.

A Method of Painting Concrete Surfaces.

An article in "Hardware Trade" gives the following directions for painting concrete or cement surfaces: Slack one-half bushel of fresh stone lime in a barrel, and add in all 25 gals. of water; when slaked, and cold, add 6 gals. of the best cider vinegar and 5 lbs. of best dry Venetian red. Now mix well and then strain through a fine wire strainer. Use it when about the consistency of thin cream. Give the cement surface a coat of this, and after standing a day or so apply a coat of red lead and linseed oil paint. After this has dried you may paint the surface any color you wish. Some jobs require two coats of paint over the red lead paint. In this case make the second coat of paint serve as filled and paint both. This second coat may be made with plaster of Paris and oil, of the consistency of buttermilk. Then break up some white lead and oil to make a paint the same consistency as the plaster paint. Now take equal parts of each of the two mixtures and "box" them together, and thin to a working consistency with turpentine. This second coat should be applied as heavy as possible, or as heavy as you can spread it well. After this coat is dry apply your next and finishing coat of paint, which should be quite glossy, or about as you would for the last coat on woodwork outside. The object in giving it this plaster paint is to prevent the running and wrinkling of the paint where considerable paint is to be applied to the surface. And it must be made to dry quickly, so that you will not likely give the finishing coat before the second coat is dry enough, for if you do that there will be blistering or cracking. Observe particularly that no plaster is to go in the last or finishing coat.

Method of Underpinning the Foundation of Buildings.

In a discussion on foundations at the last annual meeting of the American Society of Civil Engineers Mr. J. C. Meem contributed the following on underpinning the foundations of buildings in Brooklyn, N. Y.:

In underpinning the buildings along the line of the Rapid Transit Subway in Brooklyn, it was sometimes necessary to go to a depth of 40 ft. below the curb line, the lower 4 ft. being sand below the level of mean high water. The method pursued in all cases was to cut out sufficient brickwork on each side of the pier to be underpinned just above the floor level and insert needle-beams (generally 20-in. 80-lb. I-beams, 18 ft. long) in sufficient numbers to carry the load. These were wedged up from a cross-blocking of heavy timbers, and cross-needle-beams were set into recesses cut in the piers, a middle beam being put through a hole cut in the pier when necessary. These beams were cemented and wedged to an absolute bearing, and were then grouted in so as to form practically a component part of the pier.

An excavation, about 8 by 8 ft. square, was then made under the foundation to a depth of about 4 ft., and supporting chains were inserted to carry the hanging portion of the foundation. A 6 by 6-ft. pit was then box-sheeted, that is, horizontal sheeting was used and set in by the well-digger's method. Cement was used in the back of the sheeting to insure filling all spaces, and holding the upper strata of loose sand in place. As soon as water level was reached, interlocking steel sheet-piling, about 5 ft. 6 in. long, was set up inside the pit in a 5 by 5-ft. square and driven down till its top was within 6 in. of the water level; then, without pumping, the sand was cleaned out to a depth of 4½ ft. and concrete was deposited through a chute until the pit was filled to about 1 ft. above the water line. Dowels of boulders or rods were left projecting from this in order to give a bond for the upper portion of the pier. As soon as the concrete had partially set, the remainder of the pier was filled in to within about 4 in. of the foundation level. After setting, this was grouted in with semi-liquid mortar, care being taken to fill every possible void by ramming and packing the grout well under the foundation. After about 5 days the beams were removed, a few at a time, and the holes in the brickwork were replaced with new masonry.

In view of the enormous forestry enterprise in the three eastern provinces of Manchuria, Viceroy Hsu Shih-chang is going to establish a school of forestry for teaching the modern methods, so as to protect China's interest in future. The proposed school will be opened in Mukden shortly.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

The Cost of Hydraulic Sluicing a Highway Embankment.

It is generally supposed that the method of hydraulicking earth can only be economically used where the yardage to be moved is quite large. This is an erroneous impression. If the situation of the excavation and the embankment is favorable for hydraulicking, together with an available water supply, sluicing of earth can be done very economically even with a very small yardage. This is made evident by an example of work done under the supervision of Mr. Wm. G. Fargo, C. E., of Jackson, Michigan.

In connection with the building of a dam in Newaygo county, Mich., a wagon road had to be changed. A cut was to be excavated and an embankment made. The cut for the most part was a side hill cut, the grade descending 15 per cent toward the river. The material had to be deposited 40 to 50 ft. below the cut, and from 100 to 500 ft. distant. In all, 20,000 cu. yds. were sluiced: but a record of the cost of only the first 3,000 cu. yds. was kept. We are thus enabled to give the cost per cubic yard, including installation of plant and other items.

For this work there was installed one 3 in. Gould's rotary fire pump. This was set up on the river bank, and a 3 in. pipe line run up the bluff. The pump was driven by a 30. H. P. motor. One 3 in. hose and a 1¼-in. nozzle were used. The trough for transporting the earth was of iron, 20 ins wide with 5-in. vertical sides, and was laid on the ground as the work progressed upward on the 15 per cent grade. The earth was held to the slopes of the embankment below by means of brush, poles and straw.

The nozzle was clamped to a 2 x 10 plank, about 12 ft. long, and this plank was pivoted to a standard similar to the jack used by a wagon wheel painter, only heavier. In a subsequent issue we shall print a photograph of this device. With this arrangement one man handled each nozzle, and was assigned one helper, for moving hose and keeping troughs in shape near the nozzle.

The material excavated with this outfit was sand and gravel. The pump and pipe line was set up in two days by two men. Four men sluiced the 3,000 cu. yds. in four days, or 750 cu. yds. per day.

The cost of plant for this work was as follows:

3-in. Gould pump	$200
500 lin. ft. steel trough 50c per lin ft.	250
3-in. pipe line and fittings	250
30 H. P. motor	450
	$1,150

The labor costs were:

Setting up Plant.	
2 men 20 hrs. at 20c per hr.	$ 8
Sluicing.	
4 men 40 hrs. at 20c per hr.	$32
1 man 40 hrs. at 25c per hr.	10
Dismantling Plant.	
2 men 10 hrs. at 20c per hr.	$4
Total labor	$54

The man at 25 cts. an hour ran motor and attended to the pump.

The power to run the motor was furnished by an electric power plant already in operation, the charge for the power being 1 ct. per k. w. hour. This is a very low charge, and the current must have been generated by water power, to cost so little. A k. w. hr. is equal to 1.33 h. p. hr. Then for a cost of 1 ct. per k. w. hr. converted into h. p. hr. gives a cost of 0.8 ct., or 8 cts per 10 hr. day per h. p. Thus for 30 h. p. we have a cost of only $2.40. In as much as a ton of coal is needed for a 30 h. p. engine for 10 hrs., it is abvious that the cost is extremely low as coal can seldom be bought and delivered for any such price, and nothing is allowed for labor. Estimating the cost of a ton of coal and the wages of a fireman at $7.50 a day, we have 1 ct. per cu. yd. for power.

Summarizing we have the following cost per cu. yd. on this 3,000-yd. job:

	Per-Cu. Yd. Cents.
Installating and dismantling plant	0.4
Labor sluicing	1.4
Straw, oil, water, etc.	0.1
Electricity at 1 ct. per k w. hr.	0.3
Total, exclusive of wear and tear	2.2

Had steam been used the cost for power would probably have been 1 ct. per cu. yd., as above stated, instead of 0.3 ct., making a total of about 3 cts. per cu. yd. for this work, exclusive of interest and depreciation. We have no information as to what the daily cost of plant rental actually was. Since the first cost of the plant was only $1,150, a charge of $6 a day for plant rental would exceed 100% per annum,, even though the plant were idle one-third of the time; but $5 a day is only ¾ ct. per cu. yd.

As a further indication of the economy of using water to transport earth, even in small quantities, an example will be cited from the experience of one of the editors of this journal. In building a wagon road, he had a cut to excavate and transport to an adjoining fill. Just behind the cut was a small stream that crossed the road. The idea came to him to sluice the material by means of this stream from the cut into the fill. The grade of 4 to 5 percent running through the cut gave fall enough to carry the dirt laden water.

Accordingly a trench was excavated through the cut with scrapers, a wooden trough laid in the trench and the stream dammed, diverting the water through the cut. Then by means of men and scrapers the earth was pushed and carried into the trough, the water transporting it to the embankment. The trough was moved from one side of the cut to the other so as to keep it in the lowest part of the excavation. Small platforms were laid down over the trough and drag scrapers dumped their loads through traps into the water With such a short run for a scraper the yardage moved per scraper day was large. The cut and embankment was made in this manner for about 50% of the cost of doing the work entirely with scrapers. In this case no extra outfit was needed, the same tools that would have made the excavation without the water, being used in connection with it.

For further information on methods and costs of hydraulicking earth, the reader may consult Engineering-Contracting, Aug. 15, 1906 (2 cts. per cu. yd.); Feb. 20, 1907 (2½ cts. per cu. yd.): July 24, 1907, and Sept. 4, 1907, (various costs).

The last census shows that in the year 1900, there were manufactured $16,951,000 worth of explosives in the United States. Of this amount, $5,310,000 was for black gun powder at 4.3 cts. per lb.; $3,880,900 for blasting powder at 4 cts. per lb., and $8,247,200 for dynamite at 9.6 cts. per lb.

About $18,000,000 will be spent during the latter part of this year and in 1908 by Philadelphia for public works. This sum will be expended to complete the filtration system; to abolish grade crossings; to construct new bridges and main and branch sewers, and to grade and pave streets.

The first section of the Yuet Han Railway has been put into operation, extending from Canton, 12 miles, to Kong-Chuen. The passenger fares between these points are: First class, 50 cts.; second class, 25 cts., and third class, 15 cts. This is the line redeemed two years ago by China from the American Development Co.

Excavating with Potter Trenching Machine for 16-ft. Sewer.

The final section of the conduit work proper for the Lawrence ave. sewer at Chicago, Ill., includes the construction of 1,160 lin. ft. of 5-ring, 16 ft. diameter brick conduit from the north branch of the Chicago river to the section completed in 1901 by Farley & Green. The sewer will empty in the north branch, which is being dredged to a width of 90 ft.; ultimately this width will be increased to 180 ft.

The excavation was done by the open cut method, the width of the trench being 21 ft. and the average depth being 30.5 ft. The materials encountered in the excavation consist of a top layer of black soil, then comes about 15 ft. of soft blue clay, 6 to 8 ft. of stiff blue clay, 1 ft. of sandy loam and about 2 ft. of hard blue clay. This latter was so hard in places that its removal was facilitated by "shooting."

The first 16 to 18 ft. of excavation was done with the aid of skips and a derrick of the Kearnes type, having a 55-ft. boom and equipped with a 7x10 double drum hoisting engine. The derrick is so arranged that the boom can swing in a half circle on either side of the trench. The framework carrying the turntables spanning the trench rests on shoe timbers, these in turn resting on rollers. A runway is built ahead of these rollers and the derrick pulled ahead by means of ropes wound round the nigger head of the engine and single and double blocks. The skips are of 1 cu. yd. capacity, were filled by hand shoveling, lifted by the derrick and swung to one side of the trench, the spoil being used for filling low places, or later for completing the back filling. Fig. 1 shows this derrick. As the excavation proceeds 2-in. plank sheeting is placed and carried down to a depth of about 14 ft., 8x10-in. timber spaced 20 ft. centers being used for bracing.

A Potter trenching machine followed the derrick and skips and was used in carrying down the excavation to the required depth. Six ½ cu. yd. capacity buckets are used with this machine, there always being four buckets in the trench being filled, while the remainder are being carried back on the carriage and dumped on the completed brick work. The hardest part of the excavation was done with this machine, the clay being sticky and tenacious and coming away in hard lumps, as shown in the halftone. An average of 175 to 200 cu. yds. was excavated each day with this machine.

The wages per 8-hour day and number of men employed in excavating with the Potter trenching machine were about as follows:

	Per Day.	Total.
Engineer	$6.00	$ 6.00
Fireman	2.50	2.50
1 man on carriage	2.50	2.50
1 man on carriage	3.25	3.25
20 bottom men	2.75	55.00
1 man on dump	2.75	2.75
Foreman	3.50	3.50
Total		$75.50

One-half ton of coal was consumed each day by the machine, allowing $2.50 for this and assuming that the rent of the machine was $125 per month ($4.80 per day) the total cost per 8-hour day would be $82.80. On the basis that 175 cu. yds. of material was excavated each day the cost would be about 47 cts. per cubic yard.

The brick layers follow the trenching machine, six masons working to a shift. About 1,700 brick were used per foot of sewer, the average rate of progress being 16 ft. of sewer completed per day. This means that one brick layer puts in place 4,500 brick per day, at a cost for his labor, in the wages at $6 per 8 hours, of $1.33 per thousand of brick, or about $2.65 per cubic yard of masonry. This, of course, does not include brick layers' helpers, cost of materials or centers.

The work, which was completed recently, was done by the American Engineering & Construction Co. of Chicago, of which Mr. W. A. Shaw is president.

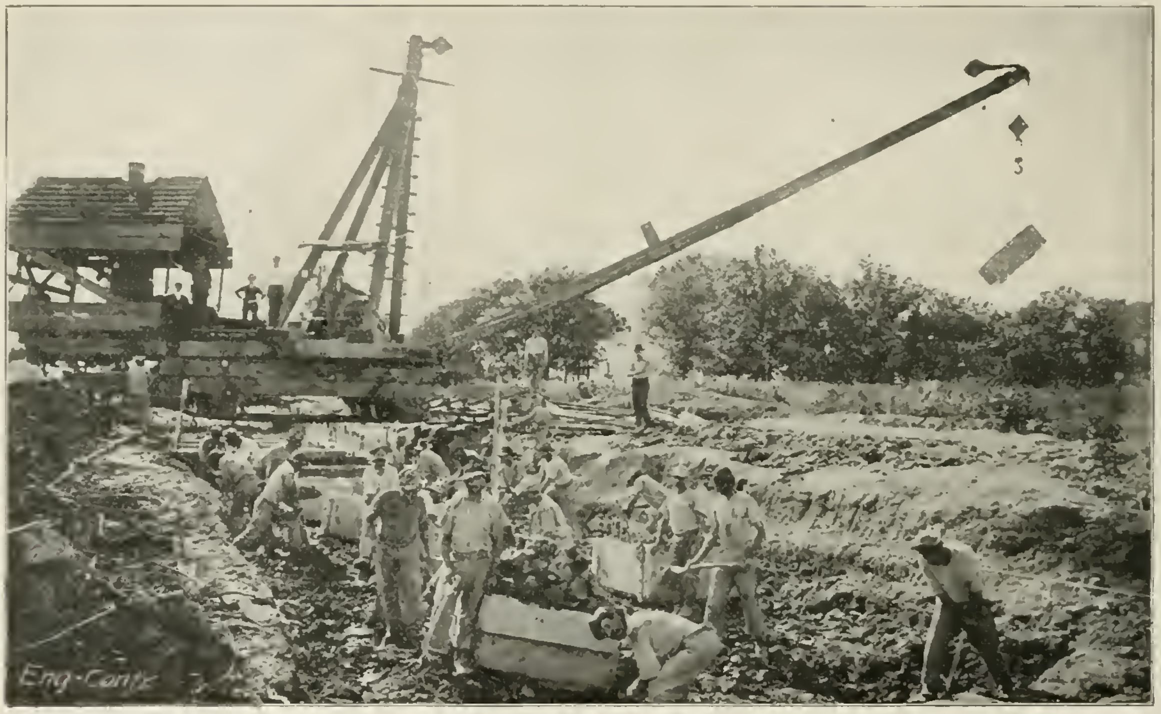


Fig. 1—Kearnes Type Derrick and Skips Used in Excavating for Sewer Trench.

A rather unusual train recently started out over the Detroit, Toledo & Ironton Ry. It consisted of 28 cars each carrying a road roller. The shipment was made by the Kelly-Springfield Road Roller Co. and all the rollers were for Pennsylvania customers.

The Government has taken formal possession of the new Custom House at New York city. The cost of the building was $7,200,000, of which $2,250,000 was for the site and the rest for the building and its furnishings.

Back Filling Trenches Under Paved Streets.*

BY GEORGE C. WARREN.†

It is pleasing to note that recent issues of engineering periodicals have devoted prominent space to this matter, which is both one of the most important and one of the most neglected matters which municipal officials and contractors have in connection with street work.

One of the articles referred to quotes from specifications of the West Park Commissioners of Chicago, which are incorporated in permits granted for making excavations in streets to reach underground service pipes. From the quotations, the following extract is of special interest.

"All material excavated from any trench under paved roadways must be removed from the boulevard; said trench being refilled with clean cinders, sand, gravel, or crushed stone, placed in layers not exceeding six inches in depth, thoroughly compacted with heavy hand rammers, using the necessary amount of water to complete perfect consolidation of the back filling."

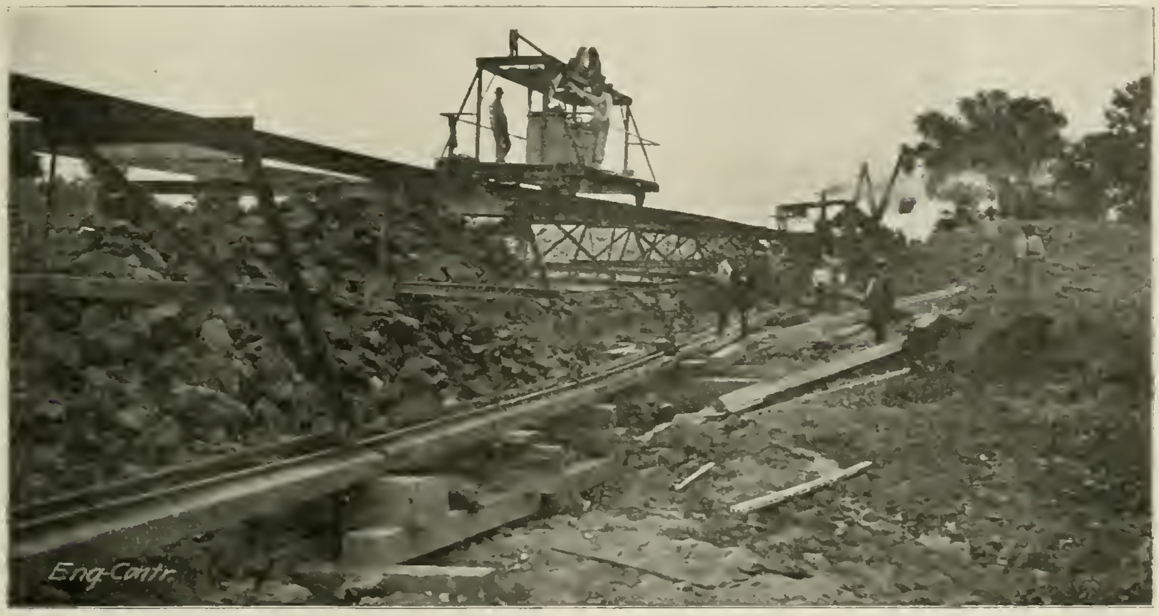


Fig. 2—Potter Trenching Machine Used for Final Excavation for Sewer Trench.

This specification is on the safe side, but for general use, it seems unnecessarily severe and expensive in the requirement that all material excavated from any trench must be removed from the street and replaced by cinders, sand, gravel, crushed stone, etc.

I refer to the removal of excavated material from the street regardless of location of work or character of material "excavated fom any trench."

My purpose is to point out the importance of the matter and to suggest practicable, general requirements for overcoming the difficulty in the most economical way in each particular case.

With quarter of a century experience in street paving throughout the United States and Canada, I believe I have met the matter of back filling of trenches in about all of its possible phases, and I appreciate that it is most difficult to draft a specification which will give:

(a) Efficient results.

(b) A basis of payment which will insure the greatest economy to the city and fairness to the contractor.

The greatest difficulty is that the method of treatment and its cost vary widely with the character of sub-soil, which often varies greatly within the limits of a single sewer or water or gas pipe trench. This cannot often be foreseen and it often varies with the weather conditions (wet or dry) which happen to prevail.

Before attempting to offer a solution I will mention a few instances known to me. There is a popular notion that trenches should be allowed to settle for a year before paving and that then it is safe. This is not only a fallacy which breeds carelessness in cases where it is thought no pavement will be laid in a year or more, but it is impracticable to defer paving a year or more after all mains and house connections are made and equally impracticable to avoid cutting into pavements for installation of and repairs to service pipes. We all know that by careless or indifferent back filling of trenches unpaved streets are often rendered dangerous and nearly impassable for years. I remember about fifteen years ago an instance in one of our older cities where an asphalt pavement was being laid replacing an old cobble pavement. The cobbles and a few inches of the underlying earth necessary to provide the sub-grade were removed; the subgrade rolled with steam roller and concrete foundation laid. While the concrete was setting there was a good deal of rain. At one point in the street the concrete settled and developed a hole into which a hoe handle was inserted the full length without finding the bottom of the hole. Investigation and subsequent examination developed a serious hollow several feet deep about two feet below the surface and over two hundred feet long, over a sewer which had been laid twenty-five years before and doubtless back filled in the generally customary way of merely throwing the earth loosely back into the trench. In this case a crust or arch of solid earth had become formed which did not develop the hollow below until the excavation for the new pavement removed a part of this crust and the rains caused the balance of the crust, in one spot, to fall into the hole.

In another instance no trouble developed in the construction of an asphalt pavement laid on concrete foundation, but three years later a horse's hoof broke through the surface of the pavement and he broke his leg. Examination revealed a hole six feet deep, which it took fifty loads of earth to fill over a sewer trench ten years old. It is very common for a pavement to settle a year or more after laying it over a sewer trench, filled several years before the pavement, where no trouble developed during the rolling and laying of the pavement. It is still more common to find almost insurmountable difficulty, while the paving is in progress, from settlement of old trenches. So much for the theory that however carelessly a trench or other fill is made it will settle itself within a year. On the other hand, I have never known of a case where trouble has followed from the settlement of sewer or service pipe trenches made immediately before the laying of the pavement where I had supervision of the back filling, even with treacherous soil conditions. I would far rather guarantee a pavement laid immediately after a sewer trench, the filling of which I could control, than five years after the laying of a sewer, the trench of which was filled with the generally customary carelessness and usual view only to least possible cost.

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*Abstract of a paper read before the convention of the American Society of Municipal Improvements, Detroit, Mich., Oct. 1-4, 1907.

†President of Warren Bros., manufacturers of bitulithic pavement.

Now, for the remedy, which is more difficult than to call attention to the common faults.

In the case of permits to service corporations, plumbers and property owners, to cut into the streets, whether paved or unpaved (the former is but little more important than the latter), it is only necessary to stipulate in the permit that "the trenches shall be back filled by such means as the city engineer may direct, depending on the character of the excavated material, in such a manner that all excavated material shall be replaced in the trench without raising the grade of the roadway. Flushing will only be permitted in cases where the sub-soil is sand or gravel or other material from which the surplus water will readily drain away, and in the case of concrete or brick sewers or pipe sewers, the joints of which have been made water-tight with bituminous cement pipe jointing cement."

A prominent contractor who has had a large experience in sewer construction and who takes the greatest care in the execution of his work, has recently written me as follows:

"In pipe sewers, no puddling of ditches should ever be allowed, for it is impossible to prevent the water from getting through the joints of the sewer pipe, and it is very likely to cause settlement in your pipe, thus breaking your cement joints. Some 20 odd years ago, in Somerville, Mass., I took the most extreme pains in having joints cemented, leaving a stretch of ditch for some few hundred feet open until the cement had thoroughly set. I personally examined every joint to see that it was a good job. We then filled the ditch, and after it was about half filled, the water was turned into the ditch from a hydrant. In a short time the 8-in. sewer pipe at the manhole at the lower end was running half full."

In criticism of this proposed requirement reference may be made to the volume of the pipe. My reply is that except in trunk sewers (which do not apply to permits referred to), the volume of the pipe is so little in comparison to the volume of the trench as to be insignificant. It is well known that more earth can be tamped into a trench than is removed from it. In my judgment the only case where the rule of "get back all the dirt" cannot apply is in rock excavation, in which case the breaking up of the rock nearly doubles its volume and the particles of rock are so large that they cannot be replaced to their original density.

In the case of contract work for sewers, etc., the case is more difficult in view of the necessary uncertainty of conditions to be met underground, and consequent uncertainty of the most economical way to properly "back fill" the trench and consequent impracticability of the contractor accurately figuring in advance what the cost "per lin. ft." will be. On this account some contractors are sure to bid far too low to permit proper work. Others figure "safe" with the probability that if they receive the contract, the total price will be too much above the estimated cost. In one case the city has the almost impossible task of forcing the contractor to do proper work at a loss. In the other case the city will pay too much for the work. An effort should be made to avoid both evils.

My suggestion is to apportion the prices in such a way that whatever material is encountered a fair price will be allowed the contractor for each as follows:

(a) Furnishing and setting pipes per lin. ft.

(b) Earth excavation per lin. ft. (providing for varying prices for varying depths of sewer.

(c) Rock excavation per lin. ft. (providing for varying prices for varying depths of earth.)

(d) Hauling excavated material to spoil bank (if unsuitable for back filling and its removal directed by the engineer) per cu. yd.

(e) Lumber delivered on work (if any is required for shoring) per M. B. M.

(f) Placing and replacing (if lumber reused) in sewer trench per M. B. M.

(g) Refilling trench if back filled by flushing earth excavated from trench per cu. yd.

(h) Refilling trench if back filled by tamping earth excavated from trench per cu. yd.

(i) Refilling trench if back filled by flushing suitable borrowed material (to replace unsuitable excavated material drawn to spoil bank by order of engineer) including furnishing the material per cu. yd. measured in the wagons as material is delivered.

(j) Refilling trench if back filled by tamping suitable borrowed material (conditions the same as item "i") per cu. yd.

(k) Refilling trench with rock excavated from the trench per cu. yd.

Corresponding with such a schedule of prices in proposal and contract, the specifications should provide as follows:

1st. Material excavated from the trench, which in the opinion of the engineer is unsuitable for back filling, shall be hauled by the contractor to a spoil bank and shall be paid for at the price bid per cu. yd. for "hauling excavation to spoil bank," measurement to be made in the wagons at point where loaded.

2d. Flushing in back filling will be permitted only in case the material is sand or gravel or other material, from which in the opinion of the engineer the surplus water will readily drain away and leave the earth filled solid.

3d. Except where flushing is directed by the engineer, the back filling shall be done by thorough, hard tamping in layers not exceeding six (6) inches in depth. Flushing will not be permitted except in cases of brick or concrete sewers or pipe sewers, the joints of which have been made water-tight with bituminous pipe jointing cement.

4th. Whether back filling of earth is done by flushing or tamping the full amount of material excavated from the trench less the volume of the sewer shall be refilled into the trench without raising the grade.

5th. In case rock is excavated from the trench, it shall be back filled by carefully placing the excavated rock in layers with succeeding layers of earth well flushed into the voids between the pieces of placed rock.

6th. In case the excavated material is clay, which in the opinion of the engineer is too wet to enable solid back filling by tamping, the excavated wet clay and reasonably dry "borrowed" earth shall be tamped into the trench in succeeding layers, using enough of the dry earth to overcome the excess of water in the clay and to provide a solidly filled trench to the satisfaction of the engineer. The "borrowed" earth including tamping, to be paid for per cu. yd. of borrowed material" tamped into the trench. Measurement of the borrowed material is to be made in the wagons as delivered on the work.

A prominent engineering paper which makes a specialty of earth work published a series of tables of interesting and complete cost data, collected and tabulated with very great care. One report of twenty-six jobs on sewer sections in one city aggregating 8,882 lin. ft. shows an average cost of back filling the trenches of .0722 per cu. yd.* The soil is generally reported as good clay and that back filling was done by hand shovels. It is well known that this is a very low average cost of bare shoveling of earth under the most favorable conditions, so that the back filling must have consisted of loose shoveling of the earth into the trench. What about the condition of the roadway whether paved or unpaved following this shoddy work and what about the vehicles which have to pass over nearly two miles of this street during the next few years.

Referring to the provision above for paying for the excavation of sewers per lin.

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*[For examples and cost of this class of work, see Engineering Contracting June 12. 1907, p. 265; July 24. 1907, p. 60; Aug. 21. 1907, page 111; Sept. 18, 1907, p. 170.—Editor.]

ft., with varying prices for varying depths of sewer. It will be appreciated that at depths exceeding 8 ft. the cost of excavation in sewer trenches per cu. yd. increases very rapidly. With increased depth of sewer it requires quite complicated calculations to estimate the number of cubic yards of material excavated. The suggestion, therefore, is made for paying for excavation per lin. ft. of sewer of each size and of each depth. If, therefore, the sewer has varying depths and varying sizes of pipe, not only should separate prices per lin. ft. be taken for each size of pipe, but also for each increase over 8 ft. per ft. of depth of sewer. This method of payment for the excavation or trenching not only overcomes the necessity on the part of the engineer,—and consequent general delay in payment for the work,—of complicated calculations of the amount of earth excavated, but it also removes all possible dispute between the contractor and the engineer in case the plans are changed, either increasing or decreasing the depth of sewer, which changes are often made necessary. If, as is the general custom, payment for excavation or trenching is paid for either per lin. ft. or per cu. yd., without reference to the depth, the contractor can justly complain and will be sure to do so on the ground that not only is the amount of work being increased but the cost per cu. yd. of earth removed is being increased by reason of the increased depth. With this condition and no provision in the contract for variation of prices to meet the condition, there is pretty sure to be a dispute between the contractor and the engineer as to the proper method of payment for the additional work. An important feature in all contract work is to, as far as possible, provide a unit of price in the contract for every contingency which may arise.

An important point, not referred to above in connection with repaving over sewer trenches on paved streets, is the matter of foundation. Even with the greatest care in back filling a trench, it should be reinforced at the top by a solid Portland cement concrete foundation for the pavement. The concrete should extend over the edges of the trench about six inches on each side.

One engineering journal recently suggested that tamping the earth in back filling trenches be done with pneumatic or steam rammer. This offers food for the inventor. For the present tamping must be done by hand. The common bad practice, where there is even a pretense of tamping, is four to six shovellers to one tamper, with the weakest man in the trench because his work doesn't count in the amount of trench back filled. A good rule is to put two men with heavy rammers in the trench for each shoveller outside. Put the best men at tamping and satisfactory results will follow.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

The Cost of Six Ice Houses.

In this issue we give the detailed cost of building six frame ice houses for use on railroads. The work was done by company forces, and has been summarized so as to allow of comparison with other cheap structures, like those that have appeared in our previous issues, in this series of articles.* Wages and lists of materials are given. It will be noted that the price of lumber was very low.

Example I: Ice House 30x48 ft.; Area 1,440 sq. ft.

Weight:	Pounds.
26,000 ft. B. M. at 3,300 lbs equals	85,800
17¼ M. shingles at 150 lbs	2,600
Hardware, etc	2,000
Total, 45 tons	90,400

Lumber:	
1,280 ft. B. M. at $8	$ 10.24
7,333 ft. B. M. at $8	58.66
2,432 ft. B. M. at $8.50	20.67
2,053 ft. B. M. at $7.50	15.40
4,360 ft. B. M., 1 in., at $11	47.96
777 ft. B. M., 1 in., at $12	9.32
4,420 ft. B. M. drop siding at $13.50	59.67
400 ft. B. M. flooring at $18.50	7.40
3,072 ft. B. M. S. H., 8x16-in., at $4	12.28
26,127 ft. B. M. total at $9.20 (av.)	$241.54
17¼ M. shingles at $1.75	$30.19
Hardware:	
390 lbs. rods and bolts at $2.55 per 100 lbs	$ 9.95
1,300 lbs. at $2 per 100 lbs	26.00
Bolts, nuts and washers	11.75
6 padlocks at 13 cts	.78
Total	$48.48
Paint:	
27 gals. paint at 50 cts	$13.50
3 gals. oil at 37.5 cts	1.12
Total	$14.62
Labor:	
Engineering	$20.80
Loading material:	
1.6 days carpenter at $2.50	$ 4.00
3.2 days laborer at $2	6.40
4.8 total	$10.40
Unloading material:	
1 day carpenter	$2.50
Building ice house:	
18.5 days foreman at $80 per mo	$ 47.74
102.1 days carpenter at $2.50	256.75
43.1 days helper at $2	86.20
163.7 days total at $2.37	$390.69
Painting ice house:	
7 days helper at $2	$14.00
Tools	$32.50

SUMMARY.

Materials:	Totals.	Per Cent.
26,127 ft. B. M. at $9.20	$241.54	28.4
Shingles	30.19	3.5
Hardware	48.48	5.5
Paint	14.62	1.7
Total material	$334.83	39.1
Labor:		
Engineering	$ 20.80	2.5
4.8 days loading	10.40	1.2
1 day unloading	2.50	.3
163.7 days building at $2.37	390.69	46.0
7 days painting at $2	14.00	1.4
Total labor	$439.39	51.7
Total materials and labor	$774.22	90.8
Tools	32.50	3.8
Freight	45.00	5.4
Grand total	$851.72	100.00

	Cost per sq. ft.	Per Cent
Materials	$0.232	39.1
Labor	.305	51.7
Tools	.022	3.8
Freight	.031	5.4
Total	$0.590	100.0

Example II: Ice House 30x60; Area 1,800 sq. ft.

Weight:	Pounds.
18,600 ft. B. M. at 3,300 lbs. equals	61,380
Hardware	700
Total, 31 tons	62,080

Lumber:	
10,196 ft. B. M. at $6.50	$ 66.27
5,414 ft. B. M. at $7	37.90
1,520 ft. B. M. at $7.50	11.40
192 ft. B. M., s1s, at $9	1.73
320 ft. B. M., s4s, at $9.50	3.04
300 ft. B. M., ceiling, at $10.50	3.15
675 ft. B. M., 1x3 battens, at $16.	10.80
18,617 ft. B. M. total at $7.22 (av.)	$134.29
19 M shingles, Star A, at $1.15	$21.85
Hardware:	
690 lbs. nails at .016 ct	$10.04
Paint:	
10 gals. outside paint at 70 cts	$7.00
Labor:	
Unloading lumber:	
1 day carpenter at $2.50	$2.50
3 days laborers at $1.60	4.80
4 days total at $1.82	$7.30
Erecting ice house:	
93.5 days carpenter at $2.50	$233.75
12.5 days helper at $1.75	21.85
106 days total at $2.40	$255.60
Painting:	
4 days foreman at $75 per month	$ 9.67
2 days painter at $2.50	5.00
6 days total at $2.45	$14.67
Tools	$10.00

SUMMARY

Materials:	Totals.	Per Cent.
18,617 ft. B. M. at $7.22	$134.29	25.1
19 M. shingles at $1.15	21.85	4.1
690 lbs. nails at 1.6 cts	10.04	1.8
10 gals. paint at 70 cts	7.00	1.5
Total	$173.18	32.5
Labor:		
4 days unloading lumber at $1.82	$ 7.30	1.3
106 days erecting at $2.40	255.60	47.5

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*See Engineering Contracting Aug. 28 and Sept. 11 for articles on the cost of depots and section houses.

6 days painting at $2.45	14.07	2.6
Tools	19.00	3.5
Total materials and labor	$470.75	87.4
31 tons freight, actual (excess)	67.70	12.6
Total	$538.45	100.0

	Cost Per Sq. Ft.	Per Cent.
Materials	$0.096	32.5
Labor	0.104	54.9
Freight	0.037	12.6
Total	$0.297	100.0

Example No. III: Ice House 24x48; Area 1,152 sq. ft.

Weight:	Pounds.
16,665 ft. B. M. at 3,300 lbs	54,994
15½ M. shingles at 150 lbs	2,325
Hardware	1,500
Total (29 tons)	58,819

Lumber:	
624 ft. B. M. S. H. at $7	$ 4.37
6,420 ft. B. M at $11.50	73.83
240 ft. B. M. at $12.50	3.00
112 ft. B. M., s2s1E. at $13.40	1.50
328 ft. B. M. at $17.50	5.74
5,441 ft. B. M., s1s, No. 1, at $17.25	93.86
3,500 ft. B. M., ship lap, No. 2, at $21	73.50
16,665 ft. B. M. total (av.), $15.35	$255.80
15½ M. shingles at $2	$31.00
Hardware:	
125 lbs. 20d wire nails at $1.60	$ 2.00
355 lbs. 10d wire nails at $1.75	6.21
70 lbs. 4d wire nails at $2.10	1.47
Bolts, plates, nuts and washers	10.19
Padlocks and hinges	1.78
	$21.65
Paint:	
10 gals. outside at 84 cts	$ 8.40
9 gals. oil at 55 cts	4.95
Total	$13.35
Labor:	
Building:	
10 days carpenter at $2.64	$ 26.40
41 days carpenter at $2.25	92.25
6 3-10 days foreman at $2.50	15.75
	$134.40
Painting:	
6 days painter at $2	$12.00
Foreman	1.56
Total	$13.56

SUMMARY.

		Per Cent.
Materials:		
16,665 ft. B. M. at $15.35	$255.80	50.9
Shingles	31.00	6.2
Hardware	21.65	4.3
Paint	13.35	2.6
Total	$321.80	63.9
Labor:		
Building	$134.40	26.9
Painting	13.56	2.0
Total labor	$147.96	29.8
Total materials and labor	469.76	93.7
Tools	2.94	.5
Total	$472.70	94.2
Freight	29.00	5.8
Grand total	$501.70	100.00

	Cost Per Sq. Ft.	Per Cent.
Materials	$0.280	64.0
Labor	0.130	29.8
Tools	0.005	.5
Freight	0.015	5.7
Total	$0.430	100.0

Example IV. Ice House 24x48; Area 1,152 sq. ft.

Weight:	Pounds.
16,694 ft. B. M. at 3,300 lbs	55,090
15 M. shingles at 150 lbs	2,250
Hardware	1,000
Total (29 tons)	58,340

Lumber:	
3,200 ft. B. M. at $18	$ 57.60
256 ft. B. M. at $9	2.30
960 ft. B. M. at $9.50	9.12
4,500 ft. B. M., s1s, at $17.50	78.75
108 ft. B. M., s1s, at $17.25	1.86
221 ft. B. M. at $13	2.87
2,498 ft. B. M. at $10	27.24
312 ft. B. M., flooring, at $27.50	8.58
719 ft. B. M. at $6.50	4.67
3,120 ft. B. M. at $11	34.32
16,694 ft. B. M., total average, $13.35	$227.31
15 M. shingles at $2	$30.00
Hardware:	
Rods, washers, etc	$12.67
200 lbs. 20d nails	3.20
60 lbs. 4d nails	1.29
400 lbs. 10d nails	7.00
Locks, hinges, etc	2.08
	$26.24
Paint:	
12.5 gals. paint at 90 cts	$11.35
5.5 gals. oil at 59 cts	3.25
	$14.60
Labor:	
Building house:	
Supervision	$ 31.19
11.5 days foreman at $85 per month	34.91
45.5 days carpenter at $2.48	112.73
Total	$178.83
Banking cinders around house:	
1 day foreman at $1.74	$1.74
6 days laborers at $1	6.00
Total	$7.74
Painting:	
2 days painter at $2.25	$4.50
3 days painter at $1.75	5.25
Total	$9.75

SUMMARY.

		Per Cent.
Material:		
16,694 ft. B. M. at $13.35	$227.31	43.3
15 M. shingles at $2	30.00	5.7
Hardware	26.24	5.0
Paint	14.60	2.8
	$298.15	56.8
Labor:		
Building house	$178.83	34.1
Banking cinders	7.74	1.5
Painting	9.75	1.8
	$196.32	37.4
Materials and labor	$494.47	94.2
Tools	.77	0.1
Total	$495.24	94.3
Freight	29.00	5.7
Grand total	$524.24	100.0

	Cost Per Sq. Yd.	Per Cent.
Materials	$0.259	56.8
Labor	0.170	37.4
Tools	0.001	0.1
Freight	0.025	5.7
Total	$0.455	100.0

Example V. Ice House 24x48; Area 1,152 sq. ft.

Weight	Pounds.
18,247 ft. B. M. at 3,300 lbs	60,325
14 M. shingles at 150 lbs	2,100
Hardware	1,000
Total (32 tons)	63,425

Lumber:	
576 ft. B. M. at $12.50	$ 7.20
4,560 ft. B. M. at $11.50	52.44
3,500 ft. B. M., not ship lap, at $27.50	96.25
224 ft. B. M., No. 2 flooring, at $13.50	3.02
4,500 ft. B. M., No. 2 s1s, at $13.75	61.88
662 ft. B. M. at $11.50	7.61
225 ft. B. M. at $13	2.93
18,247 ft. B. M. total (av.) $12.68	$231.33
14 M. shingles at $2.75	$38.50
Hardware:	
2 kegs 20d nails at $2	$ 4.00
2 kegs 10d nails at $2.05	4.10
80 lbs. 4d nails at $2.45	1.96
Locks, hinges, etc	1.08
	$11.14
Labor:	
21 days foreman at $3	$ 63.00
25 days carpenter at $2.75	67.25
12.5 days carpenter at $2.50	31.25
1 day foreman at $2.14	2.14
19 days laborer at $1.50	28.50
Total	$192.14

SUMMARY.

		Per Cent.
Materials:		
Lumber, 18,247 ft. B. M. at $12.68	$231.33	45.8
Shingles, 14 M. at $2.75	38.50	7.6
Hardware	11.14	2.2
	$280.97	55.6
Labor	$192.14	38.1
Freight	32.00	6.3
	$505.11	100.0

	Cost Per Sq. Yd.	Per Cent.
Materials	$0.243	55.6
Labor	0.167	38.1
Freight	0.028	6.3
Total	$0.438	100.0

Example VI:

We are able to give the summary on another ice house 24x48 with an area 1,152 sq. ft.:

		Per Cent.
Materials	$322.81	62.2
Labor	164.72	31.8
Tools	1.69	0.3
Freight	29.00	5.7
	$518.22	100.0

	Cost Per Sq. Yd.	Per Cent.
Materials	$0.280	62.2
Labor	0.143	31.8
Tools	0.001	0.3
Freight	0.025	5.7
Total	$0.449	100.0

The labor cost per thousand feet of lumber in place was as follows:

	Per M.
Example No. I	$16.00
Example No. II	15.60
Example No. III	8.70
Example No. IV	11.00
Example No. V	10.70
Example No. VI	10.00
Average	$12.00

Methods and Costs; Some Old; Some New.

Concrete Block Well Wall.—In securing a new water supply for a small town a number of wells were sunk, the largest of these being 60 ins. diameter. This well was constructed of concrete blocks. The excavation was carried down to a depth of 35 ft. by means of circular ribs and 2 in. spruce sheathing. Coarse screened gravel was used to fill in the lower 18 ins. of this excavation. Upon this porous bed a wall of concrete blocks, with open joints, was laid. The blocks were 4 in. thick, 9 in. high and 18 in. long, and were made in an iron mold, one side of which was removable. This mold was so shaped that the blocks had a curvature corresponding to a radius of 30 in., and of such shape that ten of them, leaving proper joint room, made a complete course. A mixture of 1 part vulcanite Portland cement and 4 parts coarse sand was used; the cement and sand were mixed well with a small amount of water, the resulting mortar being rather dry. The blocks were allowed to dry and set about ten days before being placed in the wall. Screened was used to fill in the space between the back of the concrete wall and the plank sheathing.

Culvert With Street Foundation Top.—Culverts costing about $200 each were made in the following manner for passing storm water under the intersection of a street being paved with asphalt and an unimproved street, provided only with surface side gutters: Along each side gutter of the unimproved street were set parallel lines of 4x20 in. rejected granite curbing, these stones forming the sides of the culverts; the bottom was formed by 4 ins. of concrete. As soon as the concrete was sufficiently dry a form of 4x4 in. timber and 2 in. planks was set up loosely and covered with tarred paper extending beyond the sidewalls of the culverts. A 1 in. layer of gravel concrete was spread on the paper, and upon this was laid and bedded sections of 3 in. No. 10 expanded metal; 5 ins. additional of 1-4-6 concrete was spread over this. This work was done in advance of the preparation of the concrete foundations for the asphalt pavement, and when this work reached the crossing, a bond was made with the culvert top and the regular 2 in. asphalt wearing surface placed. Each culvert was 4½ ft. wide, 12 ins. high and 50 ft. long.

Blasting Down Rock for Dam Filling.—In the construction of a rock filled dam for the Canyon Creek Reservoir in Utah, the portion of the dam between the face walls and the walls next the core was filled with rock dumped in, with all the spaces carefully filled. The rock for all this work was procured by blasting it from the cliffs on either side of the canyon. The blasting down of the rock was exceptional in that the conditions were unusually favorable. The Canyon on the south side, from which the main part of the rock was blasted down, was cut with seams horizontally and vertically, dividing it into blocks from 20 to 30 ft. square, the horizontal seams sloped towards the Canyon at an angle of about 40 to 60 degrees, so a blast put in 20 or 30 ft. from the face would throw down large masses of rock that averaged 130 to 150 cu. yds. to each blast. The cost of drilling was as follows:

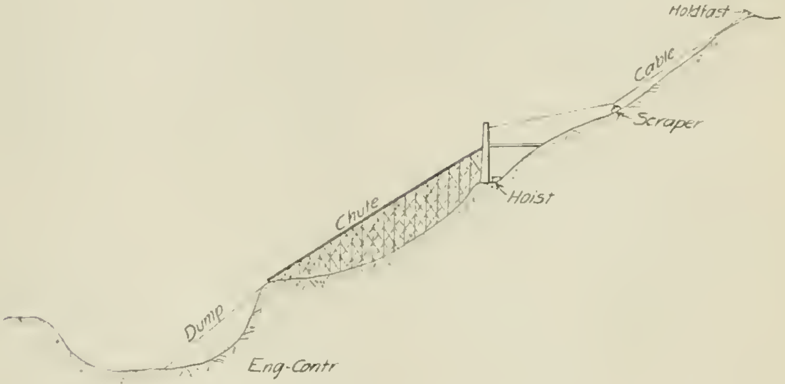
	Per Day.
3 men at $2.50 per day	$7.50
Sharpening tools	.32
Drill carrier, charged up at	.25
Wear on tools	.41
Foreman, charged up at	.50
Total, 12 ft. drilled at 75cts	$8.98

The cost of blasting was as follows:

	Per Blast.	Per cu. yd.
Average depth of holes 18 ft., drilled at 75c	$13.50	$0.10
Springing and cleaning out	1.90	0.01
250 lbs. black powder, at 7c.	17.59	0.13
20 ft. fuse, at ½c	.10	0.00
Loading and firing	1.50	0.01
Total, 135 cu. yds	$34.50	$0.25

The average amount of rock thrown down at each blast was 135 cu. yds.

Cableway Scraper.—The arrangement illustrated below was used in removing part of a hill face that caused a skew pressure on a tunnel being constructed through a hill side. As shown by the cut, the device consisted of a timber tower, about 50 ft. high, to which was attached a suspension cable of 1½ in. wire rope, secured at the uphill end to a movable holdfast, which allowed of swinging the cable laterally with the tower as the center. A boiler plate scraper pan, 6 ft. wide, was suspended from a traveling block on the cable. Up and down haul lines were attached to the scraper by a bridle arrangement, and led to the drums of a hoisting engine placed at the foot of the tower. The suspension cable was also led to one drum of the hoist by suitable blocks. This allowed of the cable with traveling block and scraper being raised or lowered by winding on or off the drum, and consequently the feed of the scraper was under control as it descended the hill. The material removed was a gravel face, the work being done during the winter months, with temperature far below zero, and the hill face deeply frozen. Before the scraping was begun a V-shaped gulley for the scraper to run in was made by blasting out stumps and frozen earth, after which the sides were picked down to furnish loose material to the scraper. At the tower the scraper emptied into a plank chute 6 ft. wide, with sides 1 ft. high. The chute was placed at an inclination 1 1-3 to 1, which was enough, except when the gravel was wet from snow or rain, and then the fine sand clogged and had to be removed with pick and shovel. When the earth piled up at the mouth of the chute, a new chute higher up or slightly to one side, was constructed. Besides filling itself, the scraper would often push down a large mass of gravel, thus sometimes carrying down from 4 to 6 cu. yds. per trip. The gravel was hard on the bottom planking of the chute, two sets of 3 in. plank being used up. About 30,000 cu. yds. were excavated at a cost of 30 cts. per cu. yd., this cost including running hoist, rigging scraper and material and labor in building the chute.



Cableway Scraper.

According to statistics recently issued by the U. S. Geological Survey, the total value of clay products in the United States in 1906 amounted to $161,032,722, as against $149,697,188 for 1905. The largest single item was common brick, the value of this product amounting to $61,300,696; pottery was the next largest item, the value of this product amounting to $31,440,884. Sewer pipe valued at $11,114,967 was the third highest item. Ohio ranked first in the value of its clay products, its productions being valued at $31,014,165; Pennsylvania was second, the total value of its clay products being $21,774,611.

Engineering Society Proceedings.

Western Society of Engineers.—At the meeting of this society, held Oct. 2, Mr. Horace E. Horton read a paper on the "Design of Open or Latticed Compression Members in Steel Structures." The paper was highly technical in character and put forward a number of suggestions and conclusions of decided novelty. Discussion was limited at the meeting, most of the bridge engineers present announcing that the technical character of the paper made careful study necessary before any adequate discussion could be made. Written discussions were promised by several members present.

Association of Railway Superintendents of Bridges and Buildings.—The annual convention of the association will be held at Milwaukee, Wis., on Oct. 15, 16 and 17, with headquarters at the Republican House. Reports will be presented by committees on Concrete Bridges, Arches and Subways; Expansion and Contraction of Concrete Walls; Concrete Building Construction; Action of Sea Water on Concrete; Wooden and Asbestos Smoke Jacks; Combination Fastening and Lock for Freight-house Doors; Towers and Guides for Lights on Draw Bridges and Protection of Steel Bridges from Action of Brine. During the convention there will be several excursions and entertainments for the members visiting the convention.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0381. **Blast Hole Drillers.**—The Cyclone Drill Co., Orville, Ohio.

Specifications for the Cyclone Special Blast Hole Driller are given in this pamphlet. The Cyclone driller is of the well drill type, but made especially for contractors. The machine on wheels weighs only 2½ tons. These specifications, together with the regular catalog of the Cyclone driller, should be in the hands of every contractor having rock excavation to do.

No. 0382. **Electric Material Hoist.** Inter-state Equipment & Engineering Company, Chicago, Ill.

This circular describes the Grable electric material hoist for contract work. These hoists are designed for handling building material and are so constructed that they may be controlled from any portion of the structure. The advantage of this is that the operator always has the work in view and can manipulate the load in the most convenient manner The machine is also claimed to be absolutely water and dirt proof and to have a capacity of from 600 to 3,000 lbs. on a single line at a speed of from 75 to 800 ft. per minute.

No. 0383. **Reinforced Concrete.**—The Ferro-Concrete Construction Co., Cincinnati, Ohio.

This catalog contains a list of reinforced concrete structures which have been constructed by the company named above. It also gives a large number of testimonial letters and numerous illustrations of buildings and other structures. There are also a number of reprints of articles which have appeared describing buildings constructed by the company.

No. 0384. **Pipe Fitters' Tools.**—D. Saunders' Sons, Inc., Yonkers, N. Y.

This is a descriptive catalog of the large line of power and hand tools manufactured by the company named for threading and cutting gas, water and steam pipe of all sizes. Each of the larger machines is illustrated and described in detail, and prices, dimensions and sizes are given of all the various tools illustrated.

No. 0385. **Portable Industrial Railways.** Arthur Koppel Company, Pittsburg, Pa.

This is a well printed and excellently illustrated catalog of the various types of industrial railway track and cars manufactured by the well known firm named above. The illustrations show the various parts constituting the Koppel industrial railway and also give details of joint connections, switches, turntables and similar parts. There are also tables showing the weight of track for different gages and the dimensions of cars of different capacities.

No. 0386. **Trench Braces.**—Kalamazoo Foundry & Machine Co., Kalamazoo, Mich.

This circular illustrates and describes the extensible trench braces made by the company named. It also gives prices of various sized braces.

No. 0387. **Sewer Traps.**—Perfect Sewer Trap Mfg. Co., New York, N. Y.

This circular describes and illustrates in some detail the construction and operation of Menhart sewer traps and automatic sewer trap valves. In addition to the descriptive matter, which has been reprinted from various trade journals, there is a large number of testimonial letters from municipal engineers and others who have used these devices in their work.

No. 0388. **Roller Bearing Axles.**—Timken Roller Bearing Axle Co., 10 E. 31st St., New York.

This catalog illustrates and describes briefly the construction of a solid tapered roller-bearing axle manufactured by the company named. These axles are suitable for use on any form of vehicle and are guaranteed against defective material or workmanship by the company. The catalog contains a general discussion of the advantages to be gained from the use of roller bearings on vehicles of various kinds. Tables are given showing dimensions of roller bearings for axles varying from $\frac{7}{8}$ in. to 3 ins. in diameter.

No. 0389. **Single Cylinder Steam Pumps.**—The John H. McGowan Company, Cincinnati, Ohio.

This catalog is devoted to one line only of the steam pumping machinery manufactured by the above-named company. Each style of pump is illustrated and has given sizes and ratings. The pumps shown vary in character from general service pumps to hydraulic pressure pumps for very large pressures. The catalog contains a number of tables useful to the engineer using pumping machinery.

No. 0390. **Electric Heating and Cooking Devices.** General Electric Co., Schenectady, N. Y.

This bulletin contains illustrations and descriptions of various forms of electric heaters designed for use on shipboard. It also similarly describes and illustrates electric cooking apparatus. The various devices are well illustrated and briefly described and they include a great variety of articles of which the ordinary individual has probably never heard.

No. 0391. **Railroad Water Service.**—American Valve & Meter Company, Cincinnati, Ohio.

This is an illustrated catalog describing the construction and explaining the operation of the Poage water column with Fenner drop spout, designed by the company named for railway water supply for locomotives. Drawings are given of various arrangements of plants together with weights, capacities, etc.

No. 0392. **Metallic Packing.**—H. W. Johns-Manville Company, New York, N. Y.

This little catalog illustrates and describes in an interesting manner the Morris rotary valve stem packing and the Morris balanced elliptic spring metallic packing. Special claims are made for each of these special packings and their application is clearly explained by the drawings. These packings are guaraneed, subject to thirty days' trial.

No. 0393. **Gas and Gasoline Engines.**—Columbus Machine Co., Columbus, Ohio.

This company manufactures gas and gasoline engines, both horizontal and vertical types. It also makes a portable horizontal engine. The engine is claimed to have superior merits in the point of simplicity of construction.

No. 0394. **Concrete Block Machines.**—Sanford & Painter Co., Toledo, Ohio.

This pamphlet describes the Sanford Press for making concrete blocks. The press makes a block for two-piece wall construction, and gives any style or pattern of face desired. Special claims are made for the light weight and great capacity of the machine.

No. 0395. **Dumping Wagons.**—The Milburn Wagon Co., Toledo, Ohio.

The wagon described in this circular is of the bottom dump type. Among the points brought out in the circular is the one that the doors close one ahead of the other, and have the joint sealed against leakage by an overlapping steel plate. A very simple and effective door operating mechanism is also claimed to be used.

Personals.

Mr. J. B. Cox has resigned his position as Chief Engineer of the Chicago Junction Ry.

Mr. J. F. Deimling has been appointed Chief Engineer of the Pere Marquette Ry., succeeding Mr. E. K. Woodward, resigned.

Mr. C. J. Rhodin, of San Francisco, Cal., has been appointed Supervising Engineer in the Department of Engineering, of the State of California.

Mr. James E. Beswick, 131 E. 17th St., New York, has been appointed an Assistant Engineer by the Board of Water Supply of New York City.

Mr. Wm. M. Lamson, 15 South Oxford St., Brooklyn, has been appointed Assistant Engineer in charge of section by the Board of Water Supply of New York City.

Mr. Wm. H. Yates, 449 W. 123d St., New York, has been appointed to the position of Assistant Engineer Designer by the Board of Water Supply of New York City.

Capt. George P. Howell and First Lieutenants John J. Kingman and Henry H. Roberts, Corps of Engineers, U. S. Army, have been ordered to report for duty in the Philippines.

Mr. H. H. McGee has been appointed Engineer in charge of new construction and maintenance of bridges and buildings by the Ulster & Delaware R. R. His headquarters will be at Rondout, N. Y.

Mr. Robert Nussdoerfer has resigned his position as Street Superintendent at Canal Dover, O., and has accepted a position as Superintendent of Construction on the sewer work being installed in that city.

A. F. Hendrix, of Fayette, N. Y., formerly an instructor in the Mines and Metallurgy Department of the University of Nebraska and a well-known consulting Mining Engineer in that region, died Oct. 4, at Gettysburg, Pa., of heart disease.

Mr. Gerard H. Matthes, for the past 10 years an engineer with the U. S. Reclamation Service, has resigned to accept a position in the office of Mr. Robert McF. Doble, Consulting Engineer to the Colorado Power Co. of Colorado Springs, Colo.

Samuel Bell, a contractor and builder, died Oct. 2, at his home in Upland, Pa., aged 76 years. Among the buildings he erected are the Crozer Theological Seminary, the South Chester Baptist Church, the Crum Lynne Baptist Church and the Village Green Baptist Church in Chester, Pa.

Mr. T. H. Brown, heretofore assistant to the Assistant Division Engineer of the Baltimore & Ohio R. R. at Pittsburg, Pa., has been appointed Assistant Division Engineer at Pittsburg, succeeding Mr. L. E. Haislip, transferred to Wheeling, W. Va., as assistant division engineer to succeed Mr. J. J. Smiley, resigned.

Mr. Elwood Mead, for a number of years Chief of Irrigation and Drainage Investigations, Office of Experiment Stations, U. S. Department of Agriculture, with headquarters at Washington, D. C., has resigned that position and will sail for Melbourne, Australia, on Oct. 11, to become chairman of the Commission on Rivers and Water Supply of the State of Victoria.

Clarence E. Henninger, a young civil engineer, died Oct. 2, from injuries received while working for a bridge construction company. He was graduated last spring from the Department of Engineering at Iowa State College, since which time he has had charge of construction work. He fell from the top of a water tower, a distance of 80 ft., and death followed in a few hours.

Mr. Francis W. Lane for the past 15 years a member of the editorial staff of the Railway Age, has resigned his position with that paper and henceforth will devote his time to independent work of a general literary and technical character. Mr. Lane became connected with the Railway Age in 1892 and has served consecutively as mechanical editor, managing editor, assistant editor-in-chief and resident editor at New York.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Oct. 9. Peru, Ind. ......Oct. 7
Oct. 10. Houston, Tex. ......Sept. 25
Oct. 10. New York, N. Y......Oct. 2
Oct. 10. Fork River, Man......Oct. 9
Oct. 12. Roblin, Man. ......Oct. 12
Oct. 12. Ottawa, Kan. ......Oct. 12
Oct. 12. Xenia, O. ......Oct. 9
Oct. 14. Bellefontaine, O. ......Sept. 25
Oct. 14. Los Angeles, Cal......Sept. 11
Oct. 14. Fredericton, N. B......Sept. 18
Oct. 14. Newcastle, Ind. ......Oct. 9
Oct. 14. Hammond, Ind. ......Oct. 9
Oct. 14. Chillicothe, O. ......Oct. 9
Oct. 14. Los Angeles, Cal......Oct. 9
Oct. 15. Dunrea, Man. ......Sept. 4
Oct. 15. Erie, Kan. ......Sept. 18
Oct. 15. Tacoma, Wash. ......Oct. 2
Oct. 15. Napa, Cal. ......Oct. 9
Oct. 17. Fort Logan Roots, Ark....Sept. 25
Oct. 18. Caldwell, Idaho ......Oct. 9
Oct. 19. Canton, China ......Sept. 4
Oct. 22. Hamilton, O. ......Oct. 2
Oct. 24. Washington, D. C......Oct. 2
Oct. 26. Chicago, Ill. ......Oct. 9
Nov. 15. Glendive, Mont. ......Oct. 2

Buildings.

Oct. 9. Pittsburg, Pa. ......Oct. 2
Oct. 9. Baltimore, Md. ......Oct. 2
Oct. 10. Washington, D. C......Sept. 25
Oct. 10. New York, N. Y......Oct. 2
Oct. 10. Louisville, Ky. ......Oct. 2
Oct. 10. Milwaukee, Wis. ......Oct. 9
Oct. 12. Prescott, Ariz. ......Sept. 18
Oct. 12. Fort Leavenworth, Kan...Oct. 2
Oct. 12. Chicago, Ill. ......Oct. 2
Oct. 12. Chicago, Ill. ......Oct. 9
Oct. 14. San Diego, Cal......Sept. 11
Oct. 14. New York, N. Y......Oct. 9
Oct. 14. New York, N. Y......Oct. 9
Oct. 15. Las Animas, Colo......Sept. 25
Oct. 15. Los Angeles, Cal......Sept. 25
Oct. 15. East Stroudsburg, Pa......Oct. 2
Oct. 15. Cairo, Ill. ......Oct. 2
Oct. 15. Indiana, Pa. ......Oct. 2
Oct. 15. Preston, Minn. ......Oct. 2
Oct. 15. Bartlett, Tex. ......Oct. 9
Oct. 15. Governors Island, N. Y. H. Oct. 9
Oct. 15. New Orleans, La......Oct. 9
Oct. 15. Sioux City, Ia......Oct. 9
Oct. 16. Springfield, O. ......Sept. 18
Oct. 16. Harrisburg, Pa. ......Sept. 25
Oct. 16. Polk, Pa. ......Oct. 2
Oct. 16. Harrisburg, Pa. ......Oct. 2
Oct. 16. Baltimore Md. ......Oct. 9
Oct. 16. Chicago, Ill. ......Oct. 9
Oct. 16. Sheldon, Ia. ......Oct. 9
Oct. 17. Peoria, Ill. ......Sept. 11
Oct. 17. Fort McPherson, Ga......Sept. 25
Oct. 17. Brooklyn, N. Y......Oct. 9
Oct. 18. Montenallo, Ala ......Sept. 18
Oct. 18. Denver, Colo. ......Sept. 25
Oct. 18. Fort Monroe, Va......Oct. 9
Oct. 18. Fort Totten, N. Y......Oct. 9
Oct. 18. Lansing, Mich. ......Oct. 9
Oct. 19. Glen Cove, N. Y......Oct. 9
Oct. 20. Hot Springs, Ark......Oct. 2
Oct. 20. Washington, Kan. ......Oct. 9
Oct. 21. Des Moines, Ia......Sept. 11
Oct. 21. Milwaukee, Wis. ......Sept. 18
Oct. 22. Secaucus, N. J......Sept. 25
Oct. 24. Lapeer, Mich. ......Oct. 9
Oct. 24. Washington, D. C......Oct. 9
Oct. 24. Lacey, Ia. ......Oct. 9
Oct. 24. Washington, D. C......Oct. 9
Oct. 25. Winston-Salem, N. C......Oct. 9
Oct. 28. East St. Louis, Ill......Oct. 2
Oct. 28. Plattsburg Barracks, N. Y. Oct. 9
Oct. 30. Terre Haute, Ind......Sept. 18
Oct. 30. Atlanta, Ga. ......Sept. 25
Oct. 30. Columbus, O. ......Oct. 2
Oct. 31. Cleveland, O. ......Oct. 2
Oct. 31. Kansas City, Mo......Oct. 9
Nov. 4. Fort Washington, Md......Oct. 9
Nov. 5. Bloomfield, Ind. ......Sept. 18
Nov. 5. Bloomfield, Ind. ......Sept. 25
Nov. 5. Flint, Mich. ......Oct. 2
Nov. 5. Portland, Me. ......Oct. 9
Nov. 9. Las Animas, Colo. ......Sept. 25
Nov. 15. Chippewa Falls, Wis......Oct. 9
Nov. 21. New Orleans, La......Oct 9

Roads and Streets.

Oct. 9. Harrisburg, Pa. ......Sept. 18
Oct. 9. Bluffton, Ind. ......Sept. 25
Oct. 9. Brooklyn, N. Y......Oct. 2
Oct. 10. Harrisburg, Pa. ......Sept. 18
Oct. 10. Harrisburg, Pa. ......Sept. 25
Oct. 10. Kansas City, Mo......Oct. 2
Oct. 10. Chicago, Ill. ......Oct. 2
Oct. 11. Enid, Okla. ......Sept. 25
Oct. 11. Cincinnati, O. ......Sept. 25
Oct. 11. Buffalo, N. Y......Oct. 2
Oct. 11. Noblesville, Ind. ......Oct. 2
Oct. 11. Noblesville, Ind. ......Oct. 2
Oct. 11. Vincennes, Ind. ......Oct. 9
Oct. 11. Milwaukee, Wis. ......Oct. 9
Oct. 12. Fort Wayne, Ind......Sept. 25
Oct. 12. Rockport, Ind. ......Oct. 2
Oct. 14. Sunman, Ind. ......Sept. 11
Oct. 14. Pittsburg, Pa. ......Oct. 9
Oct. 14. Harrisburg, Pa. ......Oct. 9
Oct. 14. East Liverpool, O......Oct. 9
Oct. 14. Skillman, N. J......Oct. 9
Oct. 14. Syracuse, N. Y......Oct. 9
Oct. 14. St. Paul, Minn......Oct. 9
Oct. 14. Louisville, Ky. ......Oct. 9
Oct. 14. Michigan City, Ind......Oct. 9
Oct. 14. Indianapolis, Ind. ......Oct. 9
Oct. 14. Crawfordsville, Ind. ......Oct. 9
Oct. 15. Oscala, Fla. ......Sept. 25
Oct. 15. Denton, Md. ......Oct. 2
Oct. 15. Bemidji, Minn. ......Oct. 9
Oct. 15. Scranton, Pa. ......Oct. 9
Oct. 16. Toledo, O. ......Oct. 9
Oct. 16. Brooklyn, N. Y......Oct. 9
Oct. 16. St. Joseph, Mich......Oct. 9
Oct. 17. West Seneca, N. Y......Oct. 9
Oct. 17. Kansas City, Mo......Oct. 9
Oct. 17. Carterville, Mo. ......Oct. 9
Oct. 17. Fort Wayne, Ind......Oct. 9
Oct. 19. Woodsfield, O. ......Oct. 9
Oct. 19. Nampa, Idaho ......Oct. 9
Oct. 21. Logansport, Ind. ......Sept. 25
Oct. 21. Montrose, Colo. ......Oct. 9
Oct. 26. Richwood, O. ......Oct. 9
Oct. 31. Fort Logan H. Roots, Ark..Oct 9
Nov 4. Peru, Ind. ......Oct. 2

Sewers.

Oct. 10. McKeesport, Pa. ......Oct. 2
Oct. 10. St. Paul, Minn......Oct. 2
Oct. 10. Lincoln, Ill. ......Oct. 9
Oct. 11. Aurora, Ind. ......Oct. 2
Oct. 11. Milwaukee, Wis. ......Oct. 9
Oct. 11. Hollidaysburg, Pa. ......Oct. 9
Oct. 12. Racine, Wis. ......Oct. 9
Oct. 14. Carthage, Mo. ......Sept. 25
Oct. 14. Steubenville, O. ......Oct. 2
Oct. 14. Oklahoma City, Okla......Oct. 9
Oct. 14. Pittsburg, Pa. ......Oct. 9
Oct. 14. New Castle, Pa......Oct. 9
Oct. 14. Chagrin Falls, O......Oct. 9
Oct. 14. St. Joseph, Mo......Oct. 9
Oct. 15. Chattanooga, Tenn. ......Oct. 3
Oct. 15. Elkhart, Ind. ......Oct. 2
Oct. 15. Oneida, N. Y......Oct. 9
Oct. 15. Hattiesburg, Miss. ......Oct. 9
Oct. 15. Decatur, Ind., ...Oct. 9
Oct. 17. West Seneca, N. Y......Oct. 9
Oct. 21. Steubenville, O. ......Oct. 9
Oct. 21. Brainerd, Minn. ......Oct. 9
Oct. 22. Spokane, Wash. ......Oct. 9
Oct. 22. Buffalo, N. Y......Oct. 9
Oct. 23. Whiterocks, Utah ......Sept. 25
Oct. 28. Aberdeen, S. Dak......Oct. 9

Water Supply.

Oct. 9. Fort Caswell, N. C......Sept. 18
Oct. 9. Fargo, N. Dak......Sept. 25
Oct. 10. Primghar, Ia. ......Sept. 18
Oct. 10. Fort Du Pont, Del......Sept. 18
Oct. 14. Ashland, O. ......Oct. 2
Oct. 22. Marion, Kan. ......Oct. 2
Oct. 22. Beaver City, Neb......Oct. 9
Oct. 23. Atlanta, Ga. ......Sept. 18
Nov. 4. Tucson, Ariz. ......Oct. 2
Nov 5. New Fort Lyon, Colo......Oct. 9
Nov. 15. Phoenix, Ariz. ......Oct. 2

Miscellaneous.

Oct. 9. Asbury Park, N. J Jetties, Sept. 25
Oct. 10. New York, N. Y., Retaining Wall, Oct. 2
Oct. 10. Newark, N. J., Garbage Disposal, Oct. 9
Oct. 14. Cincinnati, O., Concrete Wall, Etc., Sept. 25
Oct. 14. Pittsburg, Pa., Board Walks, Oct. 9
Oct. 11. Pittsburg, Pa., Concrete Steps, Oct. 9
Oct. 16. Baltimore, Md., Garbage Disposal, Oct. 9
Oct. 17. Brooklyn, N. Y., Masonry Wall, Oct. 9
Oct. 17. Brooklyn, N. Y., Masonry Walls, Etc., Oct. 9
Oct. 18. Lions Head, Ont., Wharf Extension, Oct. 9
Oct. 18. San Jose, Cal., Chimney, Oct 9
Oct. 19. Lancaster, O., Riprap, Oct. 9
Oct. 19. Fort Greble, R. I., Wharf Repairs, Oct. 9
Oct. 29. Cincinnati, O., Track Work, Oct. 2
Oct. 21. Louisville, Ky., Steel Barges, Sept. 25
Oct. 24. New York, N. Y., Signal System, Oct. 9
Oct. 24. Toccoa, Ga., Concrete Work, Oct. 9
Oct. 25. Charleston, S. C., Dredge, Sept. 25
Oct. 31. Mobile, Ala., Snagboat, Sept. 11
Nov. 4. Louisville, Ky., Snagboat Hull, Oct. 9
Nov. 8. Kokomo, Ind., Electric Lighting, Oct. 9
Nov. 15. Charleston, S C., Street Lighting, Sept. 11
Nov. 20. New Orleans, La., Dredge, Oct. 2
Nov. 25. Mobile, Ala., Locks and Dams, Oct. 2

Excavation, Earth and Rock.

Oct. 9. Jacksonville, Fla., Dredging, Sept. 18
Oct. 10. Peterboro, Ont., Canal, Sept. 4
Oct. 10. Jacksonville, Fla., Rock Removal, Sept. 18
Oct. 10. Washington, D. C., Dredging, Jetty Work, Sept. 18
Oct. 10. Jersey City, N. J., Grading, Sept. 25
Oct. 10. Jersey City, N. J., Grading, Etc., Oct. 2
Oct. 10. New Orleans, La., Levee Work, Oct. 9
Oct. 11. Boone, Ia., Drains, Oct. 2
Oct. 12. Riverton, Ala., Excavation, Riprap, Sept. 18
Oct. 15. Estherville, Ia., Ditch Work, Sept. 25
Oct. 16. Des Moines, Ia., Filling, Oct. 2
Oct. 17. Albany, N. Y., Dredging, Sept. 25
Oct. 19. Marinette, Wis., Ditch Work, Oct. 9
Oct. 21. Wilmington, Del., Dredging, Oct. 2
Oct. 22. St. Paul, Minn., Dredging, Sept. 25
Oct. 22. New Orleans, La., Canal, Oct. 2
Oct. 25. Ivanhoe, Minn. Ditch Work, Sept. 25
Oct. 30. Newport, R. I., Dredging, Oct. 9

Materials, Machines, Supplies, Tools, Etc.

Oct. 10. Buffalo, N. Y., Boilers, Oct. 2
Oct. 10. Richmond, Ind., Broken Stone, Oct. 2
Oct. 11. Buffalo, N. Y., Boilers, Oct. 2
Oct. 12. Williamsport, Pa., Street Signs, Oct. 9
Oct. 14. Washington, D. C., Dynamite, Timber, Etc., Sept. 25
Oct. 14. Ashland, O., Water Pipe, Oct. 2
Oct. 14. Pittsburg, Pa. Ladders, Laundry Equipment, Oct. 9
Oct. 14. New York, N. Y., Sand, Residuumn Oil, Oct. 9
Oct. 15. Honolulu, T. H., Materials, Sept. 4
Oct. 15. Puget Sound, Wash., Timber, Bolts, Etc. Sept. 25
Oct. 15. Mare Island, Cal., Timber, Tools, Etc., Sept. 25
Oct. 15. Norfolk, Va., Machinery, Etc., Oct. 9
Oct. 15. Charleston, S. C., Motors, Wires, Etc., Oct. 9
Oct. 15. League Island, Pa., Timber, Pipe, Etc., Oct. 9
Oct. 15. New York, N. Y., Machinery, Pipe, Etc., Oct. 9
Oct. 15. Annapolis, Md., Lathe, Cement, Etc., Oct. 9
Oct. 15. Boston, Mass., Machinery, Etc., Oct. 9
Oct. 15. Pensacola, Fla., Machinery, Oct. 9

Oct. 15. Portsmouth, N. H.,
Machinery, Oct. 9
Oct. 15. Washington, D. C.,
Rope, Pipe, Machinery, Oct. 9
Oct. 16. Ottawa, Ont.,
Asphalt Plant, Oct. 2
Oct. 16. Baltimore, Md.,
Motor, Oct. 9
Oct. 16. Atlanta, Ga.,
Boiler, Oct. 9
Oct. 17. New York, N. Y.,
Lumber, Paint, Etc., Oct. 9
Oct. 21. Louisville, Ky.,
Dump Scows, Sept. 25
Oct. 21. Chicago, Ill.,
Cement, Oct. 2
Oct. 21. Helena, Mont.,
Fire Hose, Oct. 2
Oct. 21. Washington, D. C.,
Pumps, Picks, Shovels, Etc., Oct. 2
Oct. 22. Philadelphia, Pa.,
Boilers, Pumps, Etc., Oct. 9
Oct. 22. Mare Island, Cal.,
Blower, Oct. 9
Oct. 28. Washington, D. C.,
Castings, Rope, Etc., Oct. 9
Oct. 29. Puget Sound, Wash.,
Timber, Tubing, Etc., Oct. 9
Oct. 29. Mare Island, Cal.,
Drills, Cable, Etc., Oct. 9
Oct. 31. Cleveland, O.,
Mechanical Equipment, Oct. 2
Nov. 4. Washington, D. C.,
Tanks, Meters, Etc., Oct. 9
Nov. 4. Washington, D. C.,
Tools, Meters, Etc., Oct. 9
Nov. 15. Winnipeg, Man.,
Water Pipe, Oct. 9

BIDS ASKED.

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Los Angeles, Cal.—Until 2 p. m., Oct. 14, by C. G. Keyes, county clerk, for constructing concrete culvert on Grand Ave., Covina Road District.

Napa, Cal.—Until Oct. 15, by N. W. Collins, clerk county supervisors, for building stone arch bridge over Milliken Creek.

Caldwell, Idaho.—Until Oct. 18, by O. V. Bradley, clerk county commissioners, for constructing wagon bridge over seven-mile slough.

Chicago, Ill.—Until 11 a. m., Oct. 26, by Department Public Works, 326 City Hall, for labor and material for substructure and superstructure of a bascule bridge to be erected over North branch of Chicago River at Kinzie St.

Hammond, Ind.—Until noon, Oct. 14, by Charles A. Johnson, County Auditor, Crown Point, Ind., for complete construction and erection ready for use, the substructure, superstructure and machinery of a swing bridge over the Calumet River at Columbia Ave., in Hammond.

Newcastle, Ind.—Until 10 a. m., Oct. 14, by John M. Bundy, County Auditor, for constructing bridge over Blue River.

Ottawa, Kan.—Until noon, Oct. 12, by County Commissioners, for erection of 40-ft. truss bridge, 26-ft. girder bridge, and a 6-ft. truss bridge.

Roblin, Man., Canada.—Until noon, Oct. 12, by Charles Brydon, Secretary-Treasurer, Shell River Municipality, Roblin, for construction of bridge over Shell River, near Roblin.

Chillicothe, O.—Until noon, Oct. 14, by Chas. H. Pinto, County Auditor, for constructing two concrete or masonry abutments for bridge in Liberty Township. Bids are also asked for steel superstructure for highway bridge, 65 ft. long, in Springfield Township.

Xenia, O.—Until noon, Oct. 12, by Wm. Dodds, County Auditor, for constructing low truss bridge, 80 ft. long, in Sugar Creek Township.

Fork River, Man., Canada.—Until Oct. 10, by D. F. Wilson, Secy., Mossy River, Fork River, Man., for building a bridge across the Mossy River, near the Village of Winnipegosis. Howe truss, two 84-foot spans. Also two bridges across the Fork river, near the Village of Fork River. Howe truss, each spans of 60 ft. These bridges may be either steel or wood.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Until 2 p. m., Oct. 24, by Bernard R. Green, Superintendent of Construction, National Museum, Library of Congress, for furnishing, delivering, and setting in place, complete, the cut buff Bedford limestone and marble column shafts and marble bases required for the screens in the rotunda of the new building for the National Museum.

Washington, D. C.—Until 2 p. m., Oct. 24, by Bernard R. Green, Superintendent of Construction, Building for National Museum, Library of Congress, for furnishing, delivering and putting in place, complete, the roof covering, comprising reinforced concrete or other fireproof material, sheet copper work, and skylights, and for furnishing green roofing slate for the new building for the National Museum.

Sheldon, Ia.—Until noon, Oct. 16, by Henry Shipley, President Library Board, for erecting public library building.

Lacey, Ia.—Until Oct. 21, by C. A. Briney, Secy., for erection of school house in Sub-District No. 2, Adams Township.

Sioux City, Ia.—Until 10 a. m., Oct. 15, by Interstate Brewing Co., Fred Knepper, Secy., 817 4th St., for construction of brick or steel brewery.

Chicago, Ill.—Until 11 a. m., Oct. 16, by department of Public Works, 322 City Hall, for constructing police station at 27th St. and South Lawndale Ave.

Chicago, Ill.—Until 11 a. m., Oct. 12, by department of Public Works, 322 City Hall, for constructing fire engine house at 716 North 52d Ave.

Washington, Kan.—Until noon, Oct. 20, by S. T. Yoder, Secy. Bd. Education, for erection of high school building.

New Orleans, La.—Until noon, Oct. 15, by F. S. Shields, Secy. Sewerage and Water Board, for installing plumbing work in offices of the Sewerage and Water Board, Nos. 602-604 Carondelet St., and connecting same to the sewers.

New Orleans, La.—Until 11 a. m., Nov. 2, by Bureau of Yards and Docks, Navy Department, Washington, D. C., for constructing a dispensary building and accessories for the naval station, New Orleans, La.

Lapeer, Mich.—Until noon, Oct. 24, by Board of Control of the Michigan Home for the Feeble Minded and Epileptic, for the construction of a new dormitory building, a new bakery, and for additions and alterations to the farm house. Clark & Munger, Architects, Bay City, Mich.

Baltimore, Md.—Until 11 a. m., Oct. 16, by Edward D. Preston, Inspector of Buildings, for erection of truck house No. 4 at 929 McCulloh St.

Fort Washington, Md.—Until noon, Nov. 4, by Constructing Q. M., for construction, plumbing, heating, electric wiring and installing electric light fixtures for one double barrack building for coast artillery at Fort Washington, Md., the building to be either frame or brick.

Portland, Me.—Until 11 a. m., Nov. 5, by Capt. F. J. Morrow, Constructing Q. M., 478½ Congress St., Portland, for the construction, plumbing, heating, electric wiring and electric fixtures, etc., for one double barrack building at Fort Williams, Me., and one sinble barrack at Fort McKinley, Me.

Lansing, Mich.—Until noon, Oct. 18, by C. E. Tarte, General Manager, Grand Rapids, Mich., for the erection of a 2-story telephone exchange building at Lansing. E. A. Bowd, Architect, Lansing, Mich.

Kansas City, Mo.—Until 11 a. m., Oct. 31, by Samuel A. Boyer, County Clerk, for constructing the buildings (inclosing and putting in floors) for the new Jackson County Home for the Aged and Infirm. Smith & Rea, Architects, 722 Dwight Bldg., Kansas City.

Winston-Salem, N. C.—Until 10 a. m., Oct. 25, by M. D. Bailey, Chairman County Commissioners, for erection and completion of the new county jail agreeable to plans and specifications prepared by Architects Frank P. Milburn & Co., Washington, D. C.

New York, N. Y.—Until 2:30 p. m., Oct. 14, by Robert W. Hebberd, Commissioner of Charities, foot of E. 26th St., for construction of six ward buildings of Seaview Hospital, Castleton Township, Richmond Borough. Security required is $300,000. Raymond F. Almirall, Archt., 51 Chambers St.

Brooklyn, N. Y.—Until 3 p. m., Oct. 17, by Park Board, Arsenal Bldg., 5th Ave. and 64th St., New York, for erection of shelter house in New Lots Park. Security required $3,500; also a shelter house in Fulton Park. Security required $10,000; and a shelter and tennis house in Prospect Park, security required $25,000. Plans, etc., at office Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn.

Fort Totten, N. Y.—Until 11 a. m., Oct. 18, by Constructing Q. M., Fort Totten, Willets Point, for alterations and repairs to barracks No. 107, 108 and 110, at this post.

Governor's Island, N. Y. H.—Until 11 a. m., Oct. 15, by Constructing Q. M., for construction, plumbing, heating, wiring and lighting fixtures, of a post exchange and gymnasium at Fort Jay, Governor's Island, N. Y. H.

New York, N. Y.—Until 11 a. m., Oct. 14, by Joseph Bermal, President Queens Borough, 5th St. and Jackson Ave., Long Island City, for rebuilding the interior of the Queens County court house at Long Island City, together with all the work incidental thereto, excepting all that provided for in the previous contract. Security required is $100,000.

Glen Cove, N. Y.—Until Oct. 19, by Town Board, for building new town hall.

Plattsburg Barracks, N. Y.—Until 10 a. m., Oct. 28, by Constructing Q. M., for constructing, plumbing and electric wiring a Quartermaster's stable and constructing a wagon shed at this post.

Bartlett, Tex.—Until Oct. 15, by G. A. Lindemann, for the erection and completion of an 11-room, 2-story brick or concrete blocks school building.

Fort Monroe, Va.—Until noon, Oct. 18, by Capt. Ernest R. Tilton, Constructing Q. M., for the installation of heating plant in quarters 45, at Fort Monroe.

Chippewa Falls, Wis.—Until 3 p. m., Nov. 15, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Chippewa Falls.

Milwaukee, Wis.—Until 5 p. m., Oct. 10, by Frank M. Harbach, Secy., Board of School Directors, for furnishing and installing electric fixtures in North Division High School.

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Logan H. Roots, Ark.—Until 11 a. m., Oct. 31, by the Constructing Q. M., for extension of sidewalks at this post.

Montrose, Colo.—Until noon, Oct. 21, by T. W. Jaycox, State Engineer, Denver, Colo., for construction and repair of about two miles of wagon road, between Paradox and Naturita.

Nampa, Idaho.—Until 8 p. m., Oct. 19, by Claude Duval, City Clerk, for constructing bitulithic pavement on portions of streets and two alleys. Certified check for $2,500 with bid.

Crawfordsville, Ind.—Until 7:30 p. m., Oct. 14, by Henry B. Hulett, City Clerk, for constructing brick pavement on Pine St., also for similar improvement on Wabash Ave.

Fort Wayne, Ind.—Until 7:30 p. m., Oct. 17, by H. W. Becker, Clk. Bd. Pub. Wks., for 8-ft. cement sidewalk on Polk St.

Indianapolis, Ind.—Until 10 a. m., Oct. 14, by Board Public Works, for three contracts for grading and paving sidewalks with cement, one contract for grading and rolling roadway and two contracts for grading and paving roadway with brick.

Michigan City, Ind.—Until 5 p. m., Oct. 14, by Board Public Works, for constructing cement sidewalk on May Ave.

Vincennes, Ind.—Until 2 p. m., Oct. 11, by C. L. V. Tucker, Ck. Bd. Pub. Wks., for 2 artificial stone sidewalks.

Louisville, Ky.—Until noon, Oct. 14, by Board Public Works, Roger G. McGrath, Secy., for constructing asphalt pavement on four streets.

St. Joseph, Mich.—Until 7 p. m., Oct. 16, by Harry L. Murphy, City Clerk, for grading and paving portions of Main St. and Broad St.

Bemidji, Minn.—Until 10 a. m., Oct. 15, by M. D. Stoner, County Superintendent of Highways, for constructing two roads.

St. Paul, Minn.—Until 2 p. m., Oct. 14, by R. L. Gorman, Clerk Bd. Pub. Wks., for grading portions of Syndicate Ave., Griggs, Dunlap, Carroll and Iglehart Sts.

Carterville, Mo.—Until Oct. 17, by H. E. Moody, City Clerk, for constructing 39,000 sq. ft. of cement sidewalks on 5 streets. Estimated cost about $5,300. F. A. Funk, City Engineer.

Kansas City, Mo.—Until 11 a. m., Oct. 17, by E. A. Harper, City Engineer, for constructing cinder sidewalks on Independence Ave.; also for 4 contracts for artificial stone curbing and 18 contracts for constructing artificial stone sidewalks.

Skillman, N. J.—Until 11 a. m., Oct. 14, by Wm. E. Drake, Chairman Executive Committe, State House, Trenton, N. J., for construction of stone roads at the New Jersey State Village efor Epileptics, Skillman, N. J. Certified check for $2,000 required.

Brooklyn, N. Y.—Until 11 a. m., Oct. 16.

by Bird S. Coler, Borough President, for 7 contracts for regulating and repaving with asphalt and 2 contracts for constructing cement concrete sidewalks.

Syracuse, N. Y.—Until 1:30 p. m., Oct. 14, by George J. Metz, City Clerk, for constructing sidewalk.

West Seneca, N. Y.—Until 4 p. m., Oct 17, by Joseph Waldraff, Town Clerk, for macadamizing and improving 4 streets.

East Liverpool, O.—Until noon, Oct. 14, by J. W. Gipner, Secy. Bd. Pub. Service, for grading and paving Pennsylvania Ave., with asphalt blocks.

Richwood, O.—Until noon, Oct. 26, by R. L. Jordan, Village Clerk, for paving Franklin St., with vitrified brick.

Toledo, O.—Until 10 a. m., Oct. 16, by D. T. Davies, Jr., County Auditor, for repairing Monroe St. stone road No. 12.

Woodsfield, O.—Until noon, Oct. 19, by Geo. P. Dorr, Village Clerk, for macadamizing West Court St.

Harrisburg, Pa.—Until noon, Oct. 14, by W. H. Lynch, Commissioner of Streets, for paving portions of 3 streets.

Pittsburg, Pa.—Until 10 a. m., Oct. 14, by A. B. Shepherd, Dir. Pub. Wks., City Hall, for grading, curbing and paving with block stone portions of 6th Ave., Webster Ave., and Glenwood Ave.; also for grading, curbing and paving with brick Rosecrans Alley, and for paving Carter Ave. with asphalt, and repaving Denniston Ave., with asphalt.

Scranton, Pa.—Until 11 a. m., Oct. 15, by C. R. Acker, Director Public Works, for constructing flagwalks.

Milwaukee, Wis.—Until 10:30 a. m., Oct. 11, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for paving National Ave. with asphalt. Also for paving alley with stone.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Lincoln, Ill.—Until 2 p. m., Oct. 10, by Chas. E. Barrow, City Clerk, for constructing 590 ft. of 12-in. vitrified pipe sewer.

Decatur, Ind.—Until Oct. 15, by City Clerk, for constructing C. D. Lewton sewer.

Oklahoma City, Okla.—Until 5 p. m., Oct. 14, by Geo. Hess, City Clerk, for constructing Blackwelder Ave. storm sewer, consisting of 2,300 lin. ft. 4-ft., 2-in., by 6-ft. 3-in., oval shape, concrete sewer.

Brainerd, Minn.—Until 8 p. m., Oct. 21, by H. J. Spencer, City Clerk, for labor and material for constructing 5,100 lin. ft. of sewer.

Hattiesburg, Miss.—Until Oct. 15, by City Clerk, for constructing 2,640 lin. ft. 15-in. sewer, 6,150 lin. ft. 10-in. sewer, 6,708 lin. ft. 8-in. sewer, 43 manholes and seven flush tanks. J. H. Putnam, City Engineer.

St. Joseph, Mo.—Until 11 a. m., Oct. 14, by Geo. F. Barnes, Clerk Bd. Pub. Wks., for construction of extension of Sycamore St. main sewer, including 1,090 lin. ft., 4-ft. circular brick, concrete or reinforced concrete, 365 lin. ft. 33-in. brick, concrete, etc., sewer, and 580 lin. ft. 30-in. sewer. Bids are also asked for extension of Grand Ave. Main sewer, 250 lin. ft. of 8-ft. circular brick, concrete or reinforced concrete sewer.

Buffalo, N. Y.—Until 11 a. m., Oct. 22, by F. G. Ward, Commissioner Pub. Wks., for constructing sewers as follows: Eller Ave., 18-in. and 20-in. tile; Fillmore Ave., 33, 36, 39, 42 and 45-in. brick; South Side Parkway, 10-in. and 15-in. tile; Bloomfield Ave., 10-in. and 12-in. tile.

Oneida, N. Y.—Until 5 p. m., Oct. 15, by Board Public Works, for sewer in Elm, Lake and Williams Sts.

West Seneca, N. Y.—Until 4 p. m., Oct. 17, by Joseph Waldraff, Town Clerk, for constructing sewer in Lebanon St.; also for sewer in Bethlehem St.

Chagrin Falls, O.—Until Oct. 14, by H. D. Bishop, Village Clerk, for constructing sewer system and sewage disposal plant, to cost about $60,000. Walter P. Rice Engineer Co., Cleveland, O., are the engineers.

Steubenville, O.—Until noon, Oct. 21, by T. W. Vance, Clerk Bd. Pub. Service, for labor and materials for 18-in. pipe sewer.

Hollidaysburg, Pa.—Until 7:30 p. m., Oct. 11, by John G. Sellers, Chairman Committee, for constructing 900 ft. of sewer.

New Castle, Pa.—Until Oct. 14, by A. E. Rhodes, City Clerk, for sanitary sewer in Chestnut St. and in Van Buren Ave.

Pittsburg, Pa.—Until 10 a. m., Oct. 14, by A. B. Shepherd, Dir. Pub. Wks., City Hall, for sewers as follows: Chance Alley, 12-in. pipe; Heberton St., 15-in. pipe; Puckety Road, 12-in. pipe; Elora Alley, 15-in. pipe; Coltart Pl., 36-in. brick relief; Chislett St., 15-in pipe; Reimer Alley, 12-in. pipe; Omega St., 15-in. pipe.

Aberdeen, S. D.—Until 8 p. m., Oct. 28, by F. W. Raymond, City Auditor, for the construction of any and all of the sewers ordered by the City Council.

Spokane, Wash.—Until 2 p. m., Oct. 22, by Board Public Wks., for constructing trunk sewer in District No. 4, and sub-trunk sewers in Districts Nos. 6 and 7. Estimated cost is $150,000.

Milwaukee, Wis.—Until 10:30 a. m., Oct. 11, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for constructing sewer in Lisbon Ave.

Racine, Wis.—Until 10 a. m., Oct. 12, by Board Public Works, for laying sewer and water services, and substituting lead services in place of iron services in Hamilton St.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Now Fort Lyon, Colo.—Until 10 a. m., Nov. 5, by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for installing a water system at the naval hospital, New Fort Lyon, Las Animas, Colo. Applications for proposals should refer to Schedule 385.

Beaver City, Neb.—Until 8 p. m., Oct. 22, by W. L. Leonard, City Clerk, for constructing system of air pressure water works.

Hundred, W. Va.—Dr. F. M. Kearns, of the Council Committee, writes us that this place is about ready to put in a water system, the water to be drawn from tanks at an elevation of about 300 to 350 ft. The estimated cost is about $10,000. Correspondence is desired with engineers and contractors. S. J. Cole is Town Recorder.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

New Orleans, La.—Levee Work.—Until 2 p. m., Oct. 10, by C. A. Harris, Secy. Orleans Levee District, 15 Masonic Temple, for following work: Lower Delacroix to Upper Beka Plantation, new levee and revetment. Length about 3,400 ft. Contents about 63,000 cu. yds. of earthwork and about 155,000 ft. B. M. of creosoted pine lumber in revetment; Beka Plantation new levee—Length about 7,700 ft. Contents about 107,000 cu. yds. of earthwork.

Newport, R. I.—Dredging.—Until 11 a. m., Oct. 30, by Lt. Col. J. H. Willard, U. S. Engrs, for dredging in Providence Harbor, R. I.

Marinette, Wis.—Ditch Work.—Until noon, Oct. 19, by Wm. C. Campbell, Sec'y. Drainage Commissioners, for ditch work in First Drainage District. The work includes: 12 ditches from ½ to 4 miles in length with a total length of 11 miles; 7,600 lin. ft. ditch with a width of 6 ft. at the bottom, with maximum cut of 9 ft. and minimum cut of 3 ft.; 45,270 lin. ft. of ditch with a width of 4 ft at the bottom, with miximum cut of 8 ft. and minimum cut of 4 ft. All ditches are to have a slope of 1 to 1, making the greatest top width 24 ft., and requiring approximately 145,000 cu. yds. of excavation. The soil is black muck underlaid with sand with a possibility of clay in a few places. The muck is from 3 ins. to 4 ft. deep. The work also includes one mile of easy clearing. The bond required is $10,000. Certified check of $500 is required with bid. A. L. Hillis, 1444 Main St., Marinette, Wis., is Engineer.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

San Jose, Cal.—Chimney.—Until 7:30 p. m., Oct. 18, by W. M. Southeimer, Secy. Board of Managers of the Agnews State Hospital, 7 West Santa Clara St., San Jose, for the construction and erection of a steel chimney or concrete chimney.

Toccoa, Ga.—Concrete Work.—Until Oct. 24, by B. P. Brown, Jr., County Ordinary, for constructing at new court house, retaining wall on south side 400 ft. long, east end 225 ft. long, and west end 225 ft. long, to be built of reinforced concrete; eight sets of steps of concrete; walks, 5 ft., 6 ft. and 8 ft. wide, respectively, etc. H. L. Lewman, Archt., Louisville, Ky.

Washington, D. C.—Tanks, Meters, Etc.—Until 10:30 a. m., Nov. 4, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Circular No. 396 the following: Oil tanks, punching and shearing machines, water meters, electrical fixtures, rubber and leather belting, belt lacing, cotton duck, drift bolts, boat spikes, nails, corn brooms, scrubbing brushes, tackle blocks, lamps, door hardware, axes, hammers, tool handles, saws, hoes, pipe cutters, wrench frames, chisels, wire rope clips, hose clamps, screw clamps, belt hooks, hasps and staples, wing dividers, oil cans, sash cord, polishing paste, lubricating oil, etc.

Kokomo, Ind.—Electric Lighting.—Until 10 a. m., Nov. 8, by Board Public Works, W. T. Meck, City Clerk, for furnishing electric lights for city.

Louisville, Ky.—Snagboat Hull.—Until noon, Nov. 4, by Capt. H. Burgess, U. S. Engrs., for steel hull for snagboat.

Baltimore, Md.—Garbage Disposal.—Until 11 a. m., Oct. 16, by J. L. Wickes, Comr. of Street Cleaning, for the removal and final disposition of garbage, dead animals and market refuse of the city of Baltimore, Md., from Jan. 1, 1908, until Jan. 1, 1918.

Newark, N. J.—Garbage Disposal.—Until 3:15 p. m., Oct. 10 (Readvertisement), by M. R. Sherrerd, Chief Engineer, Street and Water Commissioner, City Hall, for the collection, removal and disposal of ashes, rubbish material, paper and garbage in Newark for a period of five years beginning Jan. 1, 1908.

Brooklyn, N. Y.—Masonry Work, Etc.—Until 3 p. m., Oct. 17, by Park Board, New York, for following work: Labor and materials necessary to wire and light and make repairs to the Soldiers' and Sailors' Arch, Prospect Park, Brooklyn. Security $3,000; for repairs and alterations to and painting of fences around parks and on parkways in the Boroughs of Brooklyn and Queens. Security required $4,000; for repairs and alterations to the various ornamental stone entrances to Prospect Park, Borough of Brooklyn. Security required $3,000. Blank forms may be obtained at the office of the Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn.

Brooklyn ,N. Y.—Masonry Wall.—Until 3 p. m., Oct. 17, Park Board, Arsenal Bldg., 5th Ave. and 64th St., New York, for labor and materials necessary to construct a rustic masonry boundary wall around Sunset Park, Borough of Brooklyn. Security required is $25,000. Plans, etc., at office of the Department of Parks, Litchfield Mansion, Prospect Park, Brooklyn.

New York, N. Y.—Lumber, Paint, Etc.—Until 11 a. m., Oct. 17, by John V. Coggey, Commissioner of Correction, 148 E. 20th St., for furnishing and delivering hardware, paints, iron, steam fittings, lumber and miscellaneous articles.

New York, N. Y.—Sand, Residuum Oil.—Until 11 a. m., Oct. 14, by Joseph Bermel, President Queens Borough, Long Island City, for furnishing 1,500 cu. yds. sand; also residuum oil to Bureau of Highways.

New York, N. Y.—Signal System.—Until 3 p. m., Oct. 24, by James Knox Taylor, Supervising Architect, Washington, D. C., for installation of a flash-light signal system for elevators in the U. S. Custom House Building, New York. Cass Gilbert, Archt., 11 E. 24th St., New York, N. Y.

Lancaster, O.—Riprap.—Until noon, Oct. 19, by F. L. Mauger, County Auditor, for riprap work in Violet Township.

Lions Head, Ont.—Wharf Extension.—Until Oct. 18, by Fred Gelmas, Secy. Department Public Works, Ottawa, Ont., for constructing extension to wharf at Lions Head.

Pittsburg, Pa.—Concrete Steps.—Until 10 a. m., Oct. 14, by A. B. Shepherd, Dir. Pub. Wks., City Hall, for concrete steps on Brady St.

Pittsburg, Pa.—Board Walks.—Until 10 a. m., Oct. 14, by A. B. Shepherd, Dir. Pub. Wks., City Hall, for construction of board walk and steps in 23d Ward.

Fort Greble, R. I.—Wharf Repairs.—Until 10 a. m., Oct. 19, by Capt. Willis C. Metcalf, constructing Q. M., 209 Thames St., Newport, for repairs to quartermaster's wharf and ferry slip, Fort Greble.

Materials, Machines, Supplies, Tools Etc

Bids are asked on following work, the notes being arranged alphabetically by states:

Mare Island, Cal.—Blower.—Until 10 a. m., Oct. 22, by Bureau Supplies and Accounts, Washington, D. C., for furnishing rotary blower for local navy yard. Schedule 336 should be referred to.

Mare Island, Cal.—Drills, Cable, Etc.—Bureau of Supplies and Accounts, Washington, D. C., until 10 a. m., Oct. 29, to furnish at navy yard, a quantity of naval supplies, as follows: Schedule 375—Electrical fittings glass tube fuses Schedule 376—Cable chain. Schedule 377—Drill chucks and drills.

Washington, D. C.—Tools, Meters, Etc.—Until 10:30 a. m., Nov. 1, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Circular 396: Oil Tanks, Punching and Shearing Machines, Water Meters, Electrical Fixtures, Rubber and Leather Belting, Belt Lacing, Cotton Duck, Drift Bolts, Boat Spikes, Nails, Corn Brooms, Scrubbing Brushes, Tackle Blocks, Lamps, Door Hardware, Axes, Hammers, Tool Handles, Saws, Hoes, Pipe Cutters, Wrench Frames, Chisels, Wire Rope Clips, Hose Clamps, Screw Clamps, Belt Hooks, Hasps and Staples, Wing Dividers, Oil Cans, Sash Cord, Polishing Paste, Lubricating Oil, etc.

Washington, D. C.—Rope, Pipe, Machinery.—Until 10 a. m., Oct. 15, by Bureau of Supplies and Accounts, Washington, D. C., until 10 a. m., Oct. 15, to furnish at the navy yard, Washington, D. C., a quantity of naval supplies, among which are the following: Schedule 338: Melting furnace, planing and milling machines. Schedule 360—Chain drive, nickel steel chain, wire rope, machine steel, nickel steel, forgings and castings, chemicals, salicornia lye, brass tubes, black and galvanized iron pipe.

Washington, D. C.—Castings, Rope, Etc.—Until 10:30 a. m., Oct. 28, by H. F. Hodges, General Purchasing Agent, Isthmian Canal Commission, for furnishing under Circular 395, Block and Phosphorous Tin, Malleable Castings for Dump Cars, Grease Cups, Wire Screenings, Wire and Manila Rope, Lights, Auger Bits, Wrought Washers, Nuts, Desks, Chairs, etc.

Pensacola, Fla.—Machinery.—Until 10 a. m., Oct. 15, by Bureau Supplies and Accounts, Washington, D. C., for furnishing at naval station, Pensacola, a quantity of naval supplies, as follows. Schedule 337—Wood planing and mortising machines, wood turning lathe, mortising and relishing machine, grooving head. Schedule 341—Drilling outfit, drill press, screw-cutting lathes, boltthreading machine.

Atlanta, Ga.—Boiler.—Until 11 a. m., Oct. 16, by Capt. Charles C. Clark, Q. M., for supply f. o. b. cars at Port Royal, S. C., one 30 H. P. Boiler.

Boston, Mass.—Machinery, Etc.—Until 10 a. m., Oct. 15, by Bureau of Supplies and Accounts, Washington, D. C., to furnish at the navy yard, Boston, Mass., a quantity of naval supplies, among which are the following: Schedule 338—Milling machines, bolt-threading and nut-tapping machine, engine lathes, upright drills, sensitive drills, drill, tool and emery grinders, buffing and strapping machine, hydrostatic press, sawing, slotting, and metal-planing machines, boring and turning mill. Schedule 361—Steel nuts, nickel steel. Schedule 365—Rolled bronze.

Annapolis, Md.—Lathe, Cement, Etc.—Until 10 a. m., Oct. 15, by Bureau of Supplies and Accounts, Washington, D. C., to furnish at the Naval Academy, Annapolis, Md., a quantity of naval supplies, as follows: Schedule 343—Screw cutting lathe. Schedule 359—Desks, tables. Schedule 367—Portland cement, paving blocks, granite curb, gravel, brick.

Baltimore, Md.—Motor.—Until 11 a. m., Oct. 16, by Edward D. Preston, Inspector of Buildings, to erect a 60 H. P. Shunt Field control direct current 440-volt motor at the new Eastern Female High School.

Winnipeg, Man.—Water Pipe.—Until noon, Nov. 15, by Board of Control, M. Peterson, Secy., for supply of approximately 15 miles of assorted water pipe. H. N. Ruttan, City Engineer.

Portsmouth, N. H.—Machinery.—Until 10 a. m., Oct. 15, by Bureau of Supplies and Accounts, Washington, D. C., until 10 a. m., Oct. 15, to furnish at local navy yard, a quantity of naval supplies, as follows: Schedule 340—Steam gypsy, steering engine. Schedule 341—Scroll and re-saw, scroll sawing machine, planer and jointer.

New York, N. Y.—Machinery, Pipe, Etc.—Until 10 a. m., Oct. 15, by Bureau of Supplies and Accounts, Washington, D. C., to furnish at the navy yard, New York, N. Y., etc., a quantity of naval supplies, among which are the following: Schedule 339—Screw, punching and shearing machines. Schedule 342—Structural steel. Schedule 357—Transformers. Schedule 361—Expanded metal, steel forging. Schedule 363—Miscellaneous packings. Schedule 364—Steel springs. Schedule 366—Brass pipe and fittings valves. Schedule 368—Marline spikes. Schedule 370—Hose, packings, asbestos mill board, hair felt, magnesia covering.

League Island, Pa.—Timber, Pipe, Etc.—Until 10 a. m., Oct. 15, by Bureau Supplies and Accounts, Washington, D. C., for furnishing a quantity of naval supplies, among which are the following: Schedule 362—Ash, cedar, mahogany, white oak, hackmatack knees, white pine, poplar. Schedule 368—Steel bolts and nuts, brass nuts, boiler rivets, wood and machine screws, files, wire brushes, shipping cans and cases, hack-saw blades, drills and drilling machines, pneumatic drills and hammers, oil filters and pumps, plumbers' force pumps, forges, scrapers, vises, painters' torches, packing tools, hardware and tools. Schedule 369—Rolled bronze, brass and copper rod, bar iron and steel, cold-rolled steel, slab zinc, zinc boiler plates. Schedule 370—Hose, sheet packing, rubber tubing and sheet. Schedule 372—Brass and lead pipe, valves, gauge cocks, etc.; brass and iron pipe fittings. Schedule 373—Insulating tape, slide rules, thermometers, etc.

Williamsport, Pa.—Street Signs.—Until noon, Oct. 12, by J. J. Galbraith, City Clerk, for furnishing 1,350 enameled street signs.

Philadelphia, Pa.—Boilers, Pumps, Etc.—Until noon, Oct. 22, by Chief Engineer, Bureau of Filtration, 712 City Hall, for contract No. 109—Electric equipment for Torresdale Filters; contract No. 126—Pumping engines for Lardner's Point pumping station; contract No. 127—Boilers, Torresdale pumping station; contract No. 128—Centrifugal pumping engine for Torresdale pumping station; contract No. 134—Magnesia covering and painting at Lardner's Point pumping station.

Pittsburg, Pa.—Ladders, Laundry Equipment.—Until 10 a. m., Oct. 14, by James P. Shaw, Director Department Charities and Correction, for extension ladders, fire escapes and laundry equipment, consisting of engine, washers, sterilizers, extractors, dry rooms, mangles, starchers, etc.

Charleston, S. C.—Motors, Wires, Etc.—Until 10 a. m., Oct. 15, by Bureau of Supplies and Accounts, Washington, D. C., to furnish at the navy yard, Charleston, S. C., a quantity of motors, conduit and elbows, snaking wires, electrical supplies. Applications for proposals should refer to Schedule 361.

Norfolk, Va.—Machinery, Etc.—Until 10 a. m., Oct. 15, by Bureau of Supplies and Accounts, Washington, D. C., to furnish at the navy yard, Norfolk, Va., etc., a quantity of naval supplies, as follows: Schedule 338—Steam hammer. Schedule 339—Cutting-off and grinding machine. Schedule 340—Steam gypsy, steering engine, steam windlass. Schedule 357—Rubber gasket. Schedule 360—Twist drills, primers. Schedule 362—Ash. Schedule 363—Packings. Schedule 364—Brass bolts, etc., blocks and tackle, pneumatic drill and hammer, valve reseating machine, buckets, engine indicators, tools, hardware. Schedule 365—Sheet brass and copper, rolled bronze, steel. Schedule 366—Brass tubing, pipe fittings.

Puget Sound, Wash.—Timber, Tubing, Etc.—Until 10 a. m., Oct. 29, by Bureau Supplies and Accounts, Washington, D. C., for furnishing the following at local navy yard: Schedule 375—Steel tubs. Schedule 377—Fir, Ship knees, sheet brass, sheet packings, galvanized steel tubing, safety treads.

CONTRACTS LET.

The following contracts have been let recently:

Paragould, Ark.—Sewer System — W. K. Palmer Co., Kansas City, Mo., at $40,000.

Russellville, Ark.—Water Works.—James G. Lyons, Muskogee, Ind. T., at $36,920.

Oakland, Cal.—Grading—Piedmont Paving Co., for grading, curbing and guttering Second st.

Council Bluffs, Ia.—Concrete Bridge—Stark & Co., Des Moines, Ia., at $5,370, for concrete bridge over Indian Creek on Frank st.

Chicago, Ill.—Foundation Work.—American Engineering & Construction Co., 112 Clark St., for substructure work for additinn to Lake View pumping station.

Chicago, Ill.—Bridge—Fitzsimmons & Connell Co., 151 La Salle st., at $12,000, for temporary bridge at Ashland Ave.

Mendota, Ill.—Paving—Keyes & McNamara, La Salle, Ill., at $22,507, for paving Washington st. and 13th ave.

St. Charles, Ill.—Sewer System—J. A. Sparr, Springfield, Ill., at $13,473, for sewer system at State School for Boys.

Quincy, Ill.—Storm Sewer — Simons & Hartman, at $3,477.

Bluffton, Ind.—Gravel Roads—O. D. Garrett, Liberty Center, Ind., 1 road at $1,741; A. P. Addington, Bluffton, 1 road at $6,844.

Lebanon, Ind.—Road—Joseph O'Connor, at $6,579, for 3 miles of county road.

Montpelier, Ind.—Cement Walks—Lawrence Rook, Dunkirk, Ind., at $2,051.

Fort Wayne, Ind.—Grading, Etc.—Conrad Roemke, at 13¾ cts. per cu. yd., for approaches to Butt Bridge in Maumee Township; Alva Denny at 39½ cts. per cu. yd., for grading road in Lafayette Township.

New Castle, Ind.—Bridges—Pan American Bridge Co., New Castle, at $3,550, for 4 bridges.

South Bend, Ind.—Concrete Culverts—C. L. Copp, Osceola, Ind., at $2,754, for 4 concrete culverts.

Terre Haute, Ind.—Road—Wm. F. and Fred Tiffin, at $4,700, for road improvement in Lost Creek Township.

Vincennes, Ind.—Road Work—James O'Donnell, Vincennes, at $22,439, for George Pennington et al. road, contract including a $4,000 bridge and ½-mile concrete sewer; Patrick Lenahan, Vincennes, at $8,122, for C. W. Tyffe et al. road; John H. Winemiller and Jesse R. Clark, Oaktown, Ind., at $5,673, for W. A. Clark et al. road.

Cambridge, Md.—Bridge—Lingan T. Spicer, at $4,390, for bridge over Slaughter Creek.

St. Paul, Minn.—Sewer, Paving—Nicholas Feyen, at $4,412, for sewer in Franklin Ave.; Fielding & Shepley, at $2,385, for paving with sandstone alley in Block 11.

Mexico, Mo.—Sewer—John Beuth, for 1,300 ft. of sewer.

Exeter, Neb.—Water Works.—National Construction Co., South Bend, for water works fo rthis town.

Highlands, N. J.—Water Works.—McCay Engineering Co., Baltimore, Md., for water works for this town.

Schenectady, N. Y. — Grading, Paving—Beckwith Bros., grading Anthony St.; T. R. Crane, grading Kenwood St.; J. J. Malloy, grading Lake Boulevard; T. R. Crane, paving Earl Ave. and Union St. with asphalt.

Dunkirk, N. Y.—Sewers, Etc.—Lawrence Schultz, Fredonia, N. Y., at $11,641, for sanitary sewer on Central Ave.; R. C. Ruthven, for Jerboa and Armodilla St. sewers; Fred A. Gott, for Fox St. and Martin St. sewers; Patrick Goggin, Fredonia, for Canary St. sewer; Meister Contracting Co., for concrete culvert and enlarging Pine St. bridge.

Long Island City, N. Y.—Paving, Sewers, Etc.—Regulating, grading and repairing macadam Greenpoint Ave., Joseph A. Boyce, at $17,940; regulating, grading, laying sidewalks Jamaica Ave., Henry J. Mullen, at $19,884; sewers in Metropolitan Ave., etc., Joseph A. Boyce, at $29,434; public comfort station under Vernon Ave. bridge, George Hildebrand at $9,947.

New York, N. Y.—Bridge.—John C. Rodgers, 1929 Amsterdam Ave., New York, has been awarded contract for the construction of the Madison Ave. bridge over the Harlem River for the city of New York. Contract price is $1,155,987. Other bids received were as follows: The Phoenix Construction Co., $1,189,626; Williams Engineering & Contracting Co., $1,197,000; Maryland Steel Co., of Baltimore, $1,324,567; Bernard Rolf, $1,333,333.

Newton, N. C.—Electric Plant.—Southern Hydraulic Co., Washington, D. C., for electric light plant here.

Fargo, N. Dak.—Sewers, Water Mains—James Kennedy, 3 contracts for water mains; G. W. Haggart, 3 contracts for sewers.

Columbus, O.—Pipe Line—Westwater & Casey, Columbus, at $163,907, for laying pipe lines for filtration plant.

Toledo, O.—Road Work—Charles Patton, for repairing 2 miles of Dorr St. stone road.

El Reno, Okla.—Paving.—P. F. Connelly, Sioux Falls, S. Dak., for laying 30,913 sq. yds. brick pavement.

Guthrie, Okla.—Bridges — Midland Bridge Co., Kansas City, Mo., at $5,700, for 9 steel bridges and $3,900 for a frame bridge.

Troy, Pa.—Roadwork.—Dale & Gaynor, Scranton, Pa., at about $32,000 for roadwork in this borough and township.

Harrisburg, Pa.—Sewer—C. F. Hessenberger, Harrisburg, at $11,000, for portion of sewers at Pennsylvania South Mountain Sanitarium near Mont Alto.

Allegheny, Pa. — Paving — Maynard & Flynn, for paving Porter St.

McKeesport, Pa.—Bridge—McKeesport & Port Vue Bridge Co. has let contract for steel work to American Bridge Co., New York; substructure work is well under way.

Uniontown, Pa.—Bridge—Penn Bridge Co., Beaver Falls, Pa., at $63,900, for new Point Marion bridge. Other bidders were: Owego Bridge Co., Owego, N. Y., $93,231; Cleveland Bridge Co., Cleveland, O., $89,945; York Bridge Co., York, Pa., $79,989, and Nelson Construction Co., Pittsburg, $74,300.

Sumter, S. C.—Concrete Walls.—McKenzie-

Deleon Co., Atlanta, Ga., for laying concrete walls around new courthouse grounds.

Gregory, S. Dak.—Water Works.—Western Engineering Co., Yankton, S. Dak., at $11,852 for complete system for this place.

Knoxville, Tenn.—Grading — Bearden & Snyder, for grading hill between Grove City and Lonsdale.

Fort Worth, Tex.—Grading. Dennis Fegan, Dallas, Tex., grading work in connection with terminal improvements of M. K. & T. Ry.

Bremerton, Wash.—Concrete Wall.—Timothy Ryan, Seattle, Wash., for concrete quay wall at Puget Sound Navy Yard.

Superior, Wis.—Cement Sidewalks—L. J. Stewart, for work on Hughett St.; G. J. Johnson, work on Ogden St.; E. P. Ekquist, work on 16th St.; E. Hawarden, work on W. 7th St.; G. J. Johnson, work on Weeks St.

Wheeling, W. Va.—Paving, Sewers, Etc.—Geo. W. Lemmon, for 22 paving jobs at 55 cts. per cu. yd. for excavating, $1.15 for gravel filling, 5 cts. per sq. yd. for sanding and 20 cts. per sq. yd. for laying brick; Spindler & Dudley, for stone retaining walls on Charles and Coal Sts., at 60 cts. per cu. yd. for excavation, $5.73 for masonry and $4.74 for concrete; Martin Flanagan, for laying 5 sewers.

PROJECTED WORK.

Railroads.

Items Arranged Alphabetically by States.

Denver, Colo.—Denver, Laramie & Northwestern R. R. has purchased site for terminals in this city, and it is announced that construction work will be started within 60 days. The road was incorporated about 1½ years ago and has its headquarters in Denver. As projected, the road is to be built through Fort Coilins, Colo., and Laramie, Wyo., and thence to Portland and Seattle. Col. R. H. Dwyer is General Manager and C. S. Johnson is President. Ex-Senator W. A. Harris of Kansas and Sidney J. Kent, a contractor of Nebraska, are also interested.

Walden, Colo.—Laramie & Routt County R. R. Co. has been incorporated;; capital stock is $1,000,000, and headquarters are at this place. The route of the road is to be from the terminus of the Laramie, Hahn's Peak & Pacific Ry. at the state line between Colorado and Wyoming, near the North Platte River, in Larimer county, thence southwesterly through North Park to the mouth of Grizzly Creek. The incorporators include Isaac Van Horn, Holderness, N. H., and other New England parties. Fred A. Miller, Laramie, Wyo., is a Director.

Royston, Ga.—Decamps & Cunningham, Anderson, S. C., and Richardson-Wey Engineering Co., Atlanta, Ga., have been engaged to make surveys for a route for the Georgia-Carolina Ry.

Corbin, Ky.—A new road—the Nashville & Northeastern—is projected. It will connect this place with Clarksville, Tenn. The first portion of the line to be constructed will be from Corbin to Monticello, Ky., 55 miles. Samuel Woodward, Cincinnati, O., is President.

Fort Kent, Me. — Northern Railway of Maine has filed its articles of organization; capital is $500,000. The road is intended to connect two branches of the Bangor & Aroostook R. R., and with this end in view the line will be built from Fort Kent in a westerly direction, across the Fish River, through the plantations of St. John and St. Francis, 16 miles, to a point nearly opposite the mouth of the St. Francis River; also from Fort Kent, in a northerly and easterly direction, through Frenchville, Madawaska, Grand Isle and Van Buren, a distance of 45 miles, to connect with the Bangor & Aroostook terminus in Van Buren. Arthur H. Lewis, Waterville, Me., is President.

Springfield, Mo.—St. Louis and San Francisco R. R. has surveys under way for a line between Springfield and Nichols, so that work on a double track can be arranged as soon as possible. J. M. Sills, Springfield, Mo., is Resident Engineer.

Jefferson City, Mo.—Press reports from this city state that the Oklahoma, Golden City & Jefferson City R. R. Co. has taken preliminary steps looking to securing the necessary funds for the construction of the road, which is to extend from this city to Pawhuska, Okla., a distance of 261 miles. It was decided to begin work at Golden City and build 40 miles to Stockton, in Cedar County.

Amarillo, N. Mex.—Chicago, Rock Island & Pacific Ry. is said to have ordered rails for its proposed cut-off from Amarillo and Tecumcari, N. Mex. It is also said that track laying will be begun by the end of the present year. The old grade is in good condition, but will require resurfacing in spots. The cut-off will be 110 miles in length. It will run in almost a straight line between these two points named.

Goldfield, Nev.—Advices from this place state that a definite plan has been formed to construct a short road connecting Manhattan with Tonopah, with the further intention of extending it to Goldfield and to Round Mountain and Austin. The road is to be called the Nevada Gold Belt.

Cortland, N. Y.—The Cortland & Auburn R. R. Co. has been incorporated with a capital of $400,000 for the purpose of building a steam railroad from Cortland to Auburn, a distance of 40 miles. Benjamin L. Webb of Cortland, Charles B. Wheeler of Brooklyn, Charles G. Adams of Auburn, N. A. Bundy, Elliott L. Stone of Homer and E. B. Rounds of New Hope are interested.

Mount Vernon, N. Y.—The Mt. Vernon & Eastern Railroad Co., organized to operate a standard gage railroad from Mt. Vernon to Lewisboro, 35 miles long, in the county of Westchester, has filed articles of incorporation. The company is capitalized at $1,000,000. The directors include Oakleigh Thorne, William H. Cheesebrough, Carleton Bunce, Howard K. Wood and Charles E. Mitchell, all of New York; Marsden J. Perry of Providence, George Hansel of Cranford, N. J., Kennett K. McLaren of Jersey City, and Allen Wardwell of Lawrence, N. Y.

Ely, Nev.—Efforts are being made to interest New York capitalists in a project for the construction of a railroad from Ely to Goldfield, 180 miles distant. Tex Rickard is said to be interested.

Alva, Okla.—Alva & Southern R. R., with capital stock of $5,000,000, has been chartered. Headquarters are in Alva and St. Louis, Mo. It proposes to construct a line 250 miles long, south from Kiowa, Kan., through the counties of Woods, Dewey, Custer, Roger Mills and Greer in Oklahoma to the Red River. The incorporators include E. T. McKnight, President and General Manager; J. B. Cheadle, Vice President; G. E. Autrey, Secretary, and William Haviland, Assistant Secretary, all of Alva, and G. E. Autrey, Treasurer, of Granton, O.

Shawnee, Okla.—Directors of the Shawnee Central R. R. have approved the survey made by Engineer F. H. Peckham, and it is stated that work on the road will soon begin. The line is to run 100 miles east and south of Shawnee, following the valley of the Canadian River to a junction with the M., K. & T. main line.

Onalaska, Tex.—Preliminary surveys are to be made at once for the extension of the Beaumont & Great Northern R. R. to Beaumont, Tex. The road is completed and in operation between Trinity and Onalaska, and has been graded as far as Livingston. C. A. Noblitt, Onalaska, Tex., is Chief Engineer.

Madison, Wis.—The State Railway Commission has issued orders granting the Minneapolis, St. Paul & Sault Ste. Marie Ry. and its subsidiary company, the Wisconsin & Northern Minnesota Railway Company, authority to build the new lines it has asked permission to construct in Douglas County and the city of Superior. Thos. Green, Minneapolis, Minn., is Chief Engineer of the Minneapolis, St. Paul & Sault Ste. Marie Ry.

Electric Railways.

Items Arranged Alphabetically by States.

Eureka Springs, Ark.—It is expected that work will be begun at this place this fall on the line of the Rogers & Southwestern, between Rogers and Eureka Springs. The road is practically completed between Siloam Springs and Rogers.

Canon City, Colo.—Right of way is being secured for the projected Canon City, Pueblo & La Junta Electric Railway. W. C. Gould, Lamar, Colo., is interested.

Trinidad, Colo.—Stonewall Valley Electric R. R. Co. has been incorporated. Capital stock is $100,000, and it is proposed to construct a line to connect with Trinidad Electric line at Jansas and run to a point three miles west of Cokedale and from there to Stonewall.

Macon, Ga.—Press reports from this place quote W. J. Massee, Vice-President of Macon & Albany Interurban line, President of the Bibb Power Co., and Vice-President of Macon, Griffin & Atlanta Interurban lines, as announcing that the work of building the two car lines and constructing the big dam of the Bibb Power Co. across the Ocmulgee River, would commence before Jan. 1.

Decatur, Ind.—Fort Wayne & Springfield Ry. has decided to extend its line south from this place to Berne, Ind., 12 miles. Estimated cost of extension is $200,000. W. H. Fledderjohann, Decatur, is President and General Manager.

Fort Wayne, Ind.—Arrangements are stated to have been completed by the promoters of the Fort Wayne & South Bend Traction Co. which assures commencement of work on the line in the near future. The first section, 16 miles long, will be built between Nappanee and Syracuse. Perry A. Randall, Fort Wayne, Ind., is President.

Westminster, Md. Surveys are reported to have been made for the Washington, Westminster & Gettysburg R. R. Co. via Sandy Springs, Laytonsville and Westminster, Md., a distance of about 80 miles; most of the right of way is said to have been obtained. The road is to be a high speed electric trolley and will pass through a section not now provided with railroad facilities. J. B. Colegrove, of Washington, D. C., is President, and William H. Benton, Chief Engineer of the road.

Easthampton, Mass. — Eugene D. Parks, Russell, Mass., is promoting a project for an electric road from Easthampton to Loudville and then through West Farms to Florence, with a branch from Loudville to Westhampton.

Traverse City, Mich.—Articles of association of the Grand Traverse Railway Co. have been filed. The capital stock is $450,000 and the company will build an electric railway from here to Elk Rapids and then to Charlevoix. Articles of association of the Traverse City Street Railway Co., which will operate the railway in the city, were also filed. Its capital is $25,000.

Minneapolis, Minn.—The Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Co. has been organized in Maine to construct and operate an electric railway in Minnesota and Iowa. It has an authorized capitalization of $25,000,000. Eben Winthrop Freeman, of Portland, is President, and M. H. Boutelle, of Minneapolis, is Secretary.

Red Lodge, Mont.—Red Lodge Board of Trade, F. I. Johnson, Secretary, has secured Dr. Russell Kimball to make surveys for a route for projected electric railway between this place and Bear Creek.

Richmond, N. Y.—An electric traction system to be known as the Richmond & Tottenville Ry. is projected by New York parties, among whom are Thos. B. McGovern, Broad Exchange Bldg., New York, and Cornelius G. Kolff, 50 Broadway, New York. The road, for which surveys have been completed, would be about 10 miles long and would connect Richmond, Roseville, Kreischerville and Tottenville. The cost of the road and equipment is set at about $400,000.

Mangum, Okla.—Southwestern Interurban Railway Co., with headquarters at Mangum, and with $1,000,000 capital stock, has been chartered to build from Mangum via Francis to Hollis, in Greer County, 37 miles; from Mangum to Granite and Cordell, in Wichita County, 40 miles; from Granite to Hobart, 15 miles, and from Mangum to Altus, 27 miles, a total distance of 119 miles. The incorporators include W. T. Funderburk, D. J. Boyle, E. E. Pinkerton, T. P. Clay and H. M. Ferguson, all of Mangum.

Oklahoma City, Okla.—Oklahoma City Ry. Co. has filed an amended charter, by which provision is made for an additional line starting at Spencer or Choctaw City, running west through Oklahoma City to Yukon. The mileage is increased from 12 to 125 miles and the capital stock from $2,000,000 to $6,000,000. The line north from Oklahoma City is now in operation as far as Britton. Chas. W. Ford, Oklahoma City, is General Superintendent.

York, Pa.—York Railways Co. has been formed by the merging of the seven trolley companies operating here. The company plans an extension to New Cumberland and thence to Harrisburg over a new bridge at the lower end of the city.

Dillsburg, Pa.—Dillsburg & Wellsville Ry. Co., capitalized at $75,000, has been granted a charter to operate 7½ miles of trolley line between Dillsburg and Wellsville, to unite with the Cumberland Valley Traction Co. line for direct trolley connection with Harrisburg.

Oshkosh, Wis.—Winnebago Traction Co. contemplates, it is stated, expending $300,000 for improvements—$100,000 on the Oshkosh plant and cars and $200,000 in building an extension to Berlin of the Oshkosh-Omro interurban line. E. B. Kirk, Oshkosh is General Manager.

Electric and Gas Plants.

Items Arranged Alphabetically by States.

Hartsells, Ala.—Hartsells Electric Light & Power Co., has been incorporated.

Chico, Cal.—L. D. Macy has applied for a franchise to construct and operate an electric light plant in Chico.

Lodi, Cal.—Bond issue for taking over local electric light plant and water works may be voted on at next municipal election.

Napa, Cal.—The Napa Valley Electric Co. has been organized with a capital stock of $200,000 by Attorney Percy S. King, Derrel L. Beard, Henry Brown and others.

San Jose, Cal.—Estimates are being made of the cost of erecting a municipal power and lighting plant for this city.

San Jose, Cal.—According to reports from this city the National Park Electric Co. contemplates expending about $5,000,000 in the construction of power plants. A. C. Kuhn, Charles J. Kuhn and Ralph Hersey, of San Francisco, are interested.

Willow, Cal.—The Snow Mountain Electric Power Co. will erect a new power house.

Eustis, Fla.—Eustis Electric Light, Power & Water Co., capitalized at $15,000, has been incorporated by F. A. Read and others.

Clay City, Ind.—The Clay City Lighting Co. has been incorporated with a capital stock of $10,000 by L. M. Long, H. R. Vandiver, B. M. Guirl and others.

Lebanon, Ind.—Citizens' Electric Light & Power Co. has been incorporated with a capital stock of $50,000 by Richard A. Edwards, Milton A. Edwards and George R. Chamberlain.

Warrensburg, Mo.—Warrensburg Light & Power Co., is said to be planning to improve its plant.

Bay City, Mich.—City Council is considering transferring east side electric lighting station to old water works building on the west side.

Andrews, N. C.—Electric plant may be installed here.

Fremont, Neb.—City is negotiating with Fremont Gas & Electric Light Co., for purchase of its local plant.

Exeter, Neb.—City has granted franchise for furnishing electric light and power service.

Clifton Springs, N. Y.—Company may be organized to develop water power at the gristmill north of this city. F. S. Burgett is interested.

Hennessey, Okla.—The Hennessey Electric Light, Power & Ice Co. has increased its capital stock from $15,000 to $30,000.

Johnsonburg, Pa.—Johnsonburg Electric Light Co., capitalized at $25,000, has been incorporated. H. F. Randolph, Sisterville, Pa., is interested.

Alvin, Tex.—E. N. Sanctuary, Galveston, Tex., contemplates installing electric light plant and ice plant here.

Ogden, Utah.—An electric lighting system may be established at the county infirmary.

Luck, Wis.—The village of Luck, Polk County, has granted a five year franchise to Pederson Bros., to erect and operate an electric plant.

Watertown, Wis.—Escanaba Power & Pulp Co., capitalized at $500,000, has been incorporated. O. L. Huie, Marinette, Wis., is interested.

Lander, Wyo.—The Wyoming Power & Light Co., capital, $1,000,000, has been organized for the purpose of utilizing the vast water power to be derived from streams of this vicinity.

Waynesboro, Va.—The Waynesboro power plant owned by W. A. Rife is reported to have been destroyed by fire.

AD WATER WORKS.

Harmon, Ill.—A new water works system will be constructed here.

Frankfort, Kans.—The citizens have voted to issue $21,500 bonds for a water works system.

Royse City, Tex.—A $15,000 bond issue for improvement of water works has been voted.

Deforest, Wis.—This place has voted to issue bonds for a water works system.

Thermopolis, Wyo.—The proposition to issue $50,000 in bonds for a water works system was carried.

Sewers.

Items Arranged Alphabetically by States.

Ensley, Ala.—City has rejected bids received Sept. 27 for completing storm sewer, and will, it is stated, do the work by day labor. Lowest bid was $21,000. D. F. Sugg is Mayor.

Lodi, Cal.—Matter of issuing bonds for installing sewer system is under consideration.

Hartford, Conn.—Bids will be asked this fall on another section of Homestead Ave. sewer, for which $98,000 was appropriated.

Davenport, Ia.—Surveys are to be made for a main sewer in the 13th District.

Bloomington, Ill.—Pipe sewers are to be constructed in White Oak Road and Locust St.

Champaign, Ill.—Council is considering constructing sewers in Northeast portion of city.

Elgin, Ill.—Residents of the 5th ward are asking for the construction of a sanitary and storm sewer for that portion of the city.

Mount Carmel, Ill.—It is hoped to have arrangements completed so that contract for sewer system for this place can be let by Dec. 1. T. B. Wright is Mayor.

Brazil, Ind.—Council has taken steps for installing sanitary sewer system.

Togus, Me.—Following bids were received for sewer work at National Home for Disabled and Volunter Soldiers, Togus: Stacey & Co., Waterville, Me., $63,589; Bruno, Salomone & Petitti, Boston, $55,695; Shannahan, Portland, Me., $48,745; Welch & Fallon, Boston, $48,377; C. N. Taylor, Wellesley, Mass., $46,364; New York Sewerage Co., $445,800; Mr. Green, Pennsylvania, $45,989.

Howell, Mich.—City Council will be asked to take up again matter of installing sewers.

Pontiac, Mich.—City has rejected bids received Sept. 30 for constructing trunk sewer in 2nd Ward, and the work will be readvertised. Low bid was $13,200.

Minneapolis, Minn. — County Commission will appropriate $20,000 for new sewer system at county jail.

Joplin, Mo.—Plans are being prepared for construction of about two miles of pipe sewers.

Holdrege, Neb.—City has voted to issue bonds for constructing sewer system.

Humboldt, Neb.—A $6,000 sewer system is to be installed for this city. M. N. Bair, Falls City, Neb., is Engineer.

Elko, Nev.—Chamber of Commerce is advocating construction of a sewer system. System would cost about $40,000.

Corning, N. Y.—Estimates have been submitted to Board of Public Works for about 3¼ miles of sewer extensions to be made next year. Estimated cost is $11,810.

Stillwater, Ckla.—D. B. Merry, Sanitary Engineer, Winfield, Kan., has submitted to Council estimates of cost of sewer system for this place.

Allegheny, Pa.—A $10,000 bond issue is to be made for sewage disposal plant.

Seattle, Wash.—City will expend about $275,000 within the next year or so for sewers to relieve the southern end of the city. City Engineer is now preparing plans for sewer work in connection with the above.

ASPHALT PAVING.

Enid, Okla.

Sealed bids will be received at the office of the City Clerk of the City of Enid, Oklahoma Territory, until 12 o'clock noon Friday, October 11, 1907, for grading, paving, curbing, guttering, draining and otherwise improving certain streets, in accordance with laws regulating the same, and certain resolutions, ordinances and other actions of the Mayor and Council of the City of Enid, Oklahoma Territory, relative to the same, to-wit:

Grand avenue, from the north line of Randolph avenue to the north line of Walnut avenue. Walnut avenue, from the west line of Grand avenue to the east line of Independence avenue (to be paved with asphalt), about 11,500 square yards.

Plans and specifications on file at the office of the City Clerk and the City Engineer.

A certified check in the sum of $1,000 on some bank in the City of Enid will be required to accompany each bid, as a guarantee of good faith, and which shall be forfeited to the City of Enid should the bidder to whom the contract is awarded fail to qualify and enter into contract within ten days after acceptance of bid by the Mayor and Council.

A bond in the sum of 50 per cent of contract price will be required of the contractor for the faithful execution of the work and the protection of the city, and all property owners against any loss or damage caused by the negligent execution of such work.

A guarantee contract for maintenance of the above work for a period of ten years will be required of the contractor, as required in the specifications.

Bids will be opened by the Mayor and Council at the Council Chamber, at 8 o'clock p. m. on said 11th day of October, 1907, at which time and place bidders are required to be present.

The Mayor and Council reserve the right to reject any or all bids and readvertise if it should be deemed to the best interest of the city and the property owners.

E. R. Lee,
City Clerk.
C. H. SEXTON,
City Engineer.
13-2t.

WATER-WORKS.

Hundred, W. Va

Proposals are wanted for putting in a water system; supply from tanks at an elevation of about 350 ft. Estimated cost, $10,000.

F. M. KEARNS, M. D.,
Council Committee.
15tf

DEPARTMENT OF THE INTERIOR, United States Reclamation Service. Washington, D. C., Sept. 20, 1907—Sealed proposals will be received at the office of the United States Reclamation Service, 876 Federal Building, Chicago, Illinois, until 2 o'clock p. m., October 21, 1907, for furnishing 12,000 barrels of Portland cement, f. o. b. cars at the works of the bidder. For particulars address the U. S. Reclamation Service, Washington, D. C., or Chicago, Illinois. G. W. WOODRUFF, Acting Secretary. 14-2t

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WANTED—Position—Civil engineer, age 40, with exceptionally valuable experience in tunnel construction, is open for new engagement. Location no object. Address "Competent," care of Engineering-Contracting, 355 Dearborn St., Chicago.

WANTED—Railroad instrumentmen — Kansas—Needed quickly for positions as transitman and levelman on short piece of location work construction to follow and competent men will be placed in charge of construction parties; usual salaries. W 8311, Engineering Agency, Chicago.

WANTED—Catalogs and other information concerning the construction of lime kilns, especially those having steel shells and built to use crude oil fuel. N. C. Ray, Merced, Cal.

WANTED — Drawings, Maps, Lettering, Plats, Tracings to make, by experienced draftsman. 421 North Blackford St., Indianapolis, Ind.

WANTED — POSITION — Mechanical engineer 26, five years' experience shop management and construction; best references; $125 least salary. "W. E. C.," 6405 Parnell Ave., Chicago.

WANTED—Position with construction contractors in or around New York City. Concrete work preferred. At present chief clerk and assistant engineer in construction department of a large corporation. Have had five years' experience in handling men and am familiar with modern cost-keeping methods. Address "H. B.," care of Engineering-Contracting, 355 Dearborn St., Chicago. 11-4t

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WANTED—Position — Superintendent, with executive ability, to take full charge, is open for engagement. Understands how to organize or reorganize labor to produce the best results. Educated with 18 years' experience with small contracting firms on public works, and real estate developing where results had to be shown. Understands the handling and placing of temporary railways, cableways, shovels, derricks, pumps, mixers and all kinds of machinery used on various work. References as to ability and trustworthiness. Address Box 17, care Engineering-Contracting, 13-21 Park Row., N. Y. City.

WANTED—Several camp draftsmen for railway location work. Will pay $90 and expenses. Address "Camp," care of Engineering-Contracting, 355 Dearborn St., Chicago.

WANTED—Position. A well known chief engineer, 50 years of age; having had 30 years' experience on location, construction, and other railway work, is looking for change. Is especially well fitted to investigate projects and prepare estimates for investors. Address "W. P.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

WANTED—Rodmen for government railway in South America. Will pay $80 in gold and expenses, including medical attendance, etc. Two year contract. Do not answer unless prepared to advance $300 traveling expenses, of which $200 will be refunded later. We want ten good men. We have been furnishing men for two years for this work and can guarantee that everything is all right. Engineering Agency, Monadnock Block, Chicago.

DRAFTSMEN—Over 300 positions now open for mechanical and structural draftsmen; also superintendents, civil and electric engineers. Openings in New England only. Write to-day. MacGregor's Engineering Agency, 476 Main St., Worcester, Mass.; 432 Main St., Springfield, Mass.

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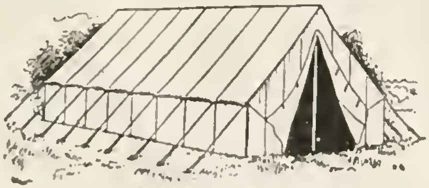

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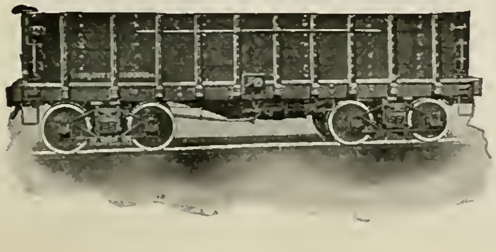

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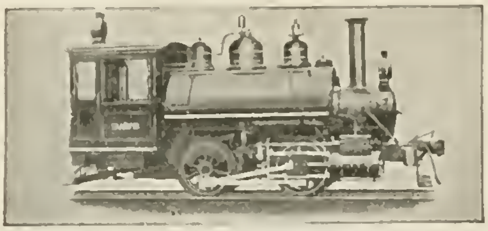

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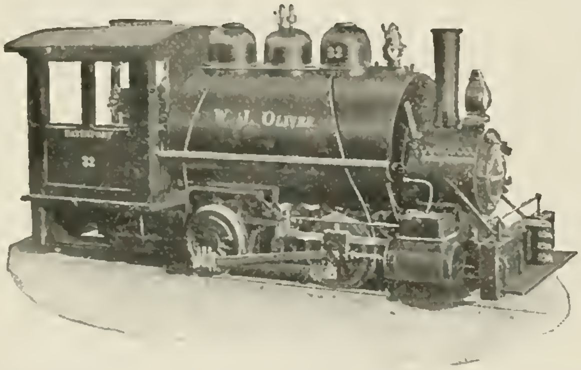

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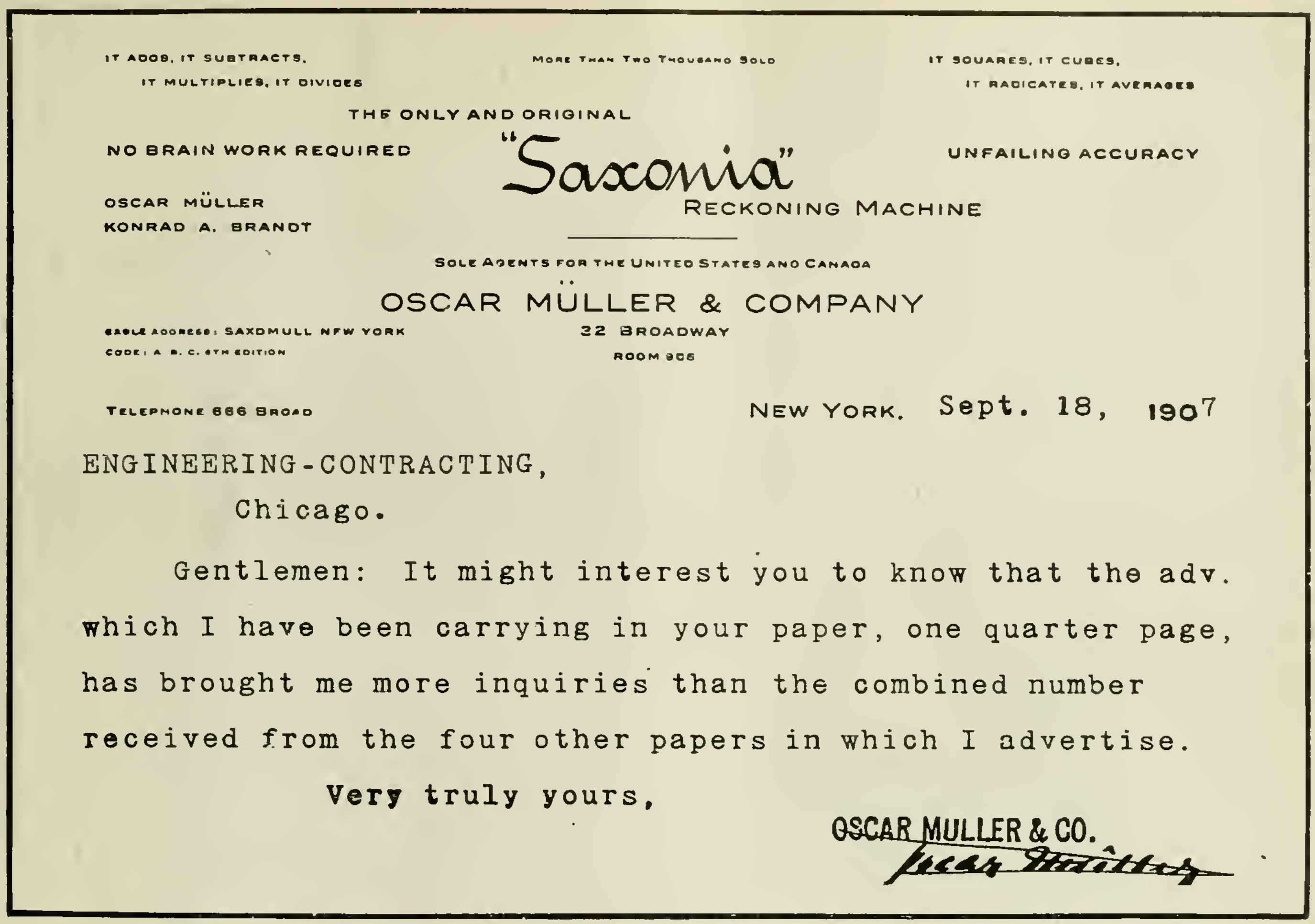

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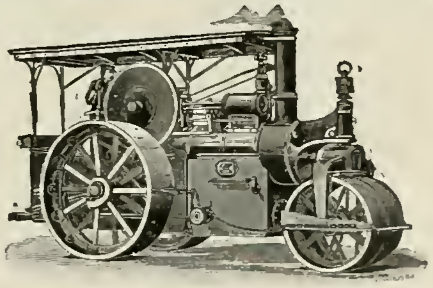

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Screened and Run of Crusher Stone.

Formerly engineers almost universally demanded that broken stone for concrete should have all the finer particles screened out. This practice has been modified to some considerable extent in recent years by using all the crusher product both coarse and fine or, as it is commonly expressed, by using run-of-crusher stone. The comparative merits of screened and crusher run stone for concrete work are questions of comparative economy and convenience. The fine stone dust and chips produced in crushing stone are not, as was once thought, deleterious; they simply take the place of so much of the sand which would, were the stone screened, be required to balance the sand and stone mixture. It is seldom that the proportion of chips and dust produced in crushing stone is large enough to replace the sand constituent entirely, some sand has nearly always to be added to run of crusher stone and it is in determining the amount of this addition that uncertainty lies. The proportions of dust and chips in crushed stone vary with the kind of stone and with the kind of crusher used. Furthermore, when run-of-crusher stone is chuted from the crusher into a bin or pile the screenings and the coarse stones segregate. Examination of a crusher-run stone pile will show a cone-shaped heart of fine material enclosed by a shell of coarser stone, consequently when this pile of stone is taken from to make concrete a uniform mixture of fine and coarse particles is not secured, the material taken from the outside of the pile will be mostly coarse and that from the inside mostly fine. This segregation combined with the natural variation in the crusher product makes the task of adding sand and producing a balanced sand and stone mixture one of extreme uncertainty and some difficulty unless considerable expenditure is made in testing and reproportioning. When the product of the crusher is screened the task of proportioning the sand to the stone is a straightforward operation, and the screened out chips and dust can be used as a portion of the sand if desired. The only saving, then, in using crusher run stone direct is the very small one of not having to screen out the fine material. The conclusion must be that the economy of unscreened stone for concrete is a very doubtful quantity, and that the risk of irregularity in unscreened stone mixtures is a serious one. The engineer's specifications will generally determine for the contractor whether he is to use screened or crusher-run stone, but these same specifications will not guarantee the regularity of the resulting concrete mixture; this will be the contractor's burden and if the engineer's inspection is rigid and the crusher-run product runs uneven for the reasons given above it will be a burden of considerable expense. The contractor will do well to know his product or to know his man before bidding less or even as little on crusher-run as on screened stone concrete.

The Durability of Concrete.

We consider that one of the most important advantages that concrete has over all its competitors among structural materials is its greater durability and freedom from repairs. It is well known to engineers and architects that the mortar in the joints of cut stone masonry soon crumbles away. This has been attributed by various authorities to many causes, such as poor cement, insufficient amount of cement in the mortar, the attack of acids in the air, and the bursting action of water freezing in the pores of the mortar. None of these causes offer a satisfactory explanation of the universal failure of mortar in cut stone masonry. It can be and has been mathematically proved that the pressure due to the expansion of the stone when heated in the sun is the most common cause of the destruction of mortar in cut stone masonry laid in regular courses. Stone expands under heat as much as does steel, and with tremendous force. It is well known to every one that steel rails expand and contract with changes of temperature, but it is not so well known that a line of stone blocks as long as a steel rail behaves in precisely the same manner. Since concrete is not made up of continuous lines of stones of equal thickness, but is a heterogeneous mixture, there is no chance for the heat expansion to shear the stone loose from the mortar.

Thus far we have spoken only of the failure of the mortar in the joints of cut stone masonry. How about the stones themselves? We know that stone from certain quarries soon splits and crumbles, and that, in fact, even granite tombstones are eaten away in time. Many engineers have feared that concrete would be even less durable, but this fear has gradually disappeared, except on one of the large eastern railways where stone masonry is still used in preference to concrete because of its supposed durability.

The reason that concrete is durable is simply this, the stone forming the ballast in concrete is surrounded on every side with cement, it is buried in cement. The cement not only protects the stone from the attacks of acids in the air but it envelopes and strengthens the stone so that it cannot splinter and crack under changes of temperature. Insects of all kinds are found buried in amber and in a perfect state of preservation thousands of years after their death. In like manner fragments of stone buried in cement will remain intact for ages. Not only will they do so, but they have done so; for concrete built by the Romans, before the Christian Era, is found in good state of preservation although Roman cement was inferior to our Portland cement. All this leads us to the following important conclusions: *Stone so poor that it would quickly go to pieces if used as stone masonry will last forever if used as the ballast of concrete.*

Not only may we safely use in concrete stone of inferior durability, but we may use stone that has no planes of cleavage, or stone that is badly seamed and jointed. Stone suitable for cut stone masonry is a comparatively rare article when we consider the vast area of our country and the small area of the good cut stone quarries in it. Stone so gnarled and jointed that it breaks out in small, irregular pieces, like many of our trap rocks, is unfit for cut stone masonry and it makes poor rubble masonry; but such stone is eminently fit for concrete. The very fact that it breaks out in small pieces reduces both the cost of quarrying and of crushing it.

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Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Compressol System of Making Concrete Foundations.

Numerous methods of constructing foundations are in vogue and many of them give most satisfactory results, but owing to the slowness and expense of construction, engineers welcome any system that will give a stable foundation, that can be obtained both quickly and cheaply. The Hennebique Construction Co. of New York, N. Y., are introducing into this country the Compressol System of Foundations, that has already been used with success in several European countries.

It is claimed that this system saves a great expenditure of time and money, and permits the construction of excellent foundations of great strength and depth. It consists of mechanically perforating the ground while compressing it vertically and laterally, then filling the hole obtained with concrete. This concrete is thoroughly tamped, thus obtaining a strong pillar of dimensions proportioned to the load it has to carry, and to the character of the soil penetrated.

The pillars are constructed by first ramming a hole in the ground by a perforator, which is lifted by a machine similar to a pile driver, which automatically trips the perforating rammer when it reaches a height of about 30 ft. This perforator is conical in form, having a diameter of 2 ft. 10 ins. at the upper base, and weighs 2 tons. By repeating the blows a hole is punched in the ground to the desired depth. At the same time the soil is compressed laterally, acting as a sheeting to the hole, preventing the earth from crumbling. In many cases it is said that this compression will also keep the water out of the hole in water soaked soils. To prevent water from coming into the hole a small amount of clay or lime can be put into the hole after each drop of the rammer, which will form a sheeting that will temporarily keep the water from welling in.

After the hole has been made, the filling is done quickly. Boulders are rammed in the bottom by means of a tamping rammer that is olive shaped and is 2 ft. 6 in. in diameter at the base, weighing 2 tons. The concrete is forced into the hole and rammed in the same manner. Each layer of concrete is well tamped in this way, and this tamping enlarges the hole, further compressing the earth, and, in soft strata, the concrete will penetrate the earth. This increases the lateral friction on the pillar, and adds to the strength. Fig. 1 shows the compressol pillar in place.

The half tone in Fig. 2 shows one machine with the penetrator ready to drop, while the other machine has suspended the testing rammer. This is a truncated cone, weighing $1\frac{1}{2}$ tons and having a large base of 2 ft. 8 in. in diameter. After the hole is filled this rammer is dropped 30 ft., and the amount of the penetration of the pillar caused by the blow, determines the bearing capacity of the pillar.

With this system of foundations, all underground work is obviated, such as excavation, sheeting, pumping, and the dangers to which workmen are subjected. The originators claim that absolute safety of the foundation is assured by permitting the actual bearing capacity of the pillars to be ascertained during construction. The record of the resisting power of each stratum of sub-soil, allows of accurate knowledge of the strength of the foundation at every point. Foundations 50 ft. deep have been made by this method, and one pillar with a bearing capacity of 90 tons has been constructed in 4 hrs.

This system has been used for the foundations of many bridges and buildings in France, Germany and Egypt. It is stated that the cost of a pillar having a carrying capacity of 90 tons is from $35 to $55.

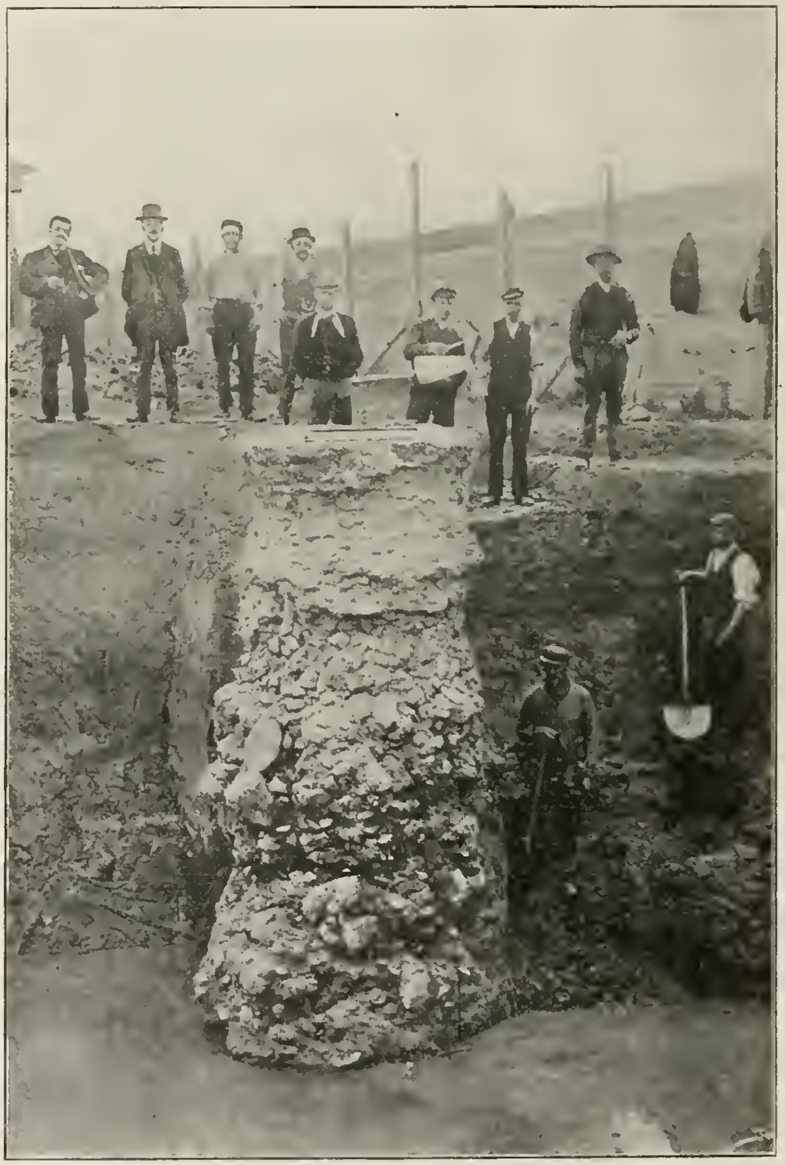

Fig. 1.—The Compressol Pillar as It Appears in the Soil.

Suggestions for the Manufacture and Use of Concrete Blocks.

No other department of the cement industry has so felt the need of standard specifications and uniform instructions as the manufacture of cement blocks. There is to-day a large and growing demand for this material, and its general and almost unlimited use is only retarded by lack of confidence on the part of architects, builders and resident owners who see only the wretched results that attend the efforts of the misinformed and inexperienced, and overlook the splendid possibilities of this form of construction in the hands of skilled and experienced operators.

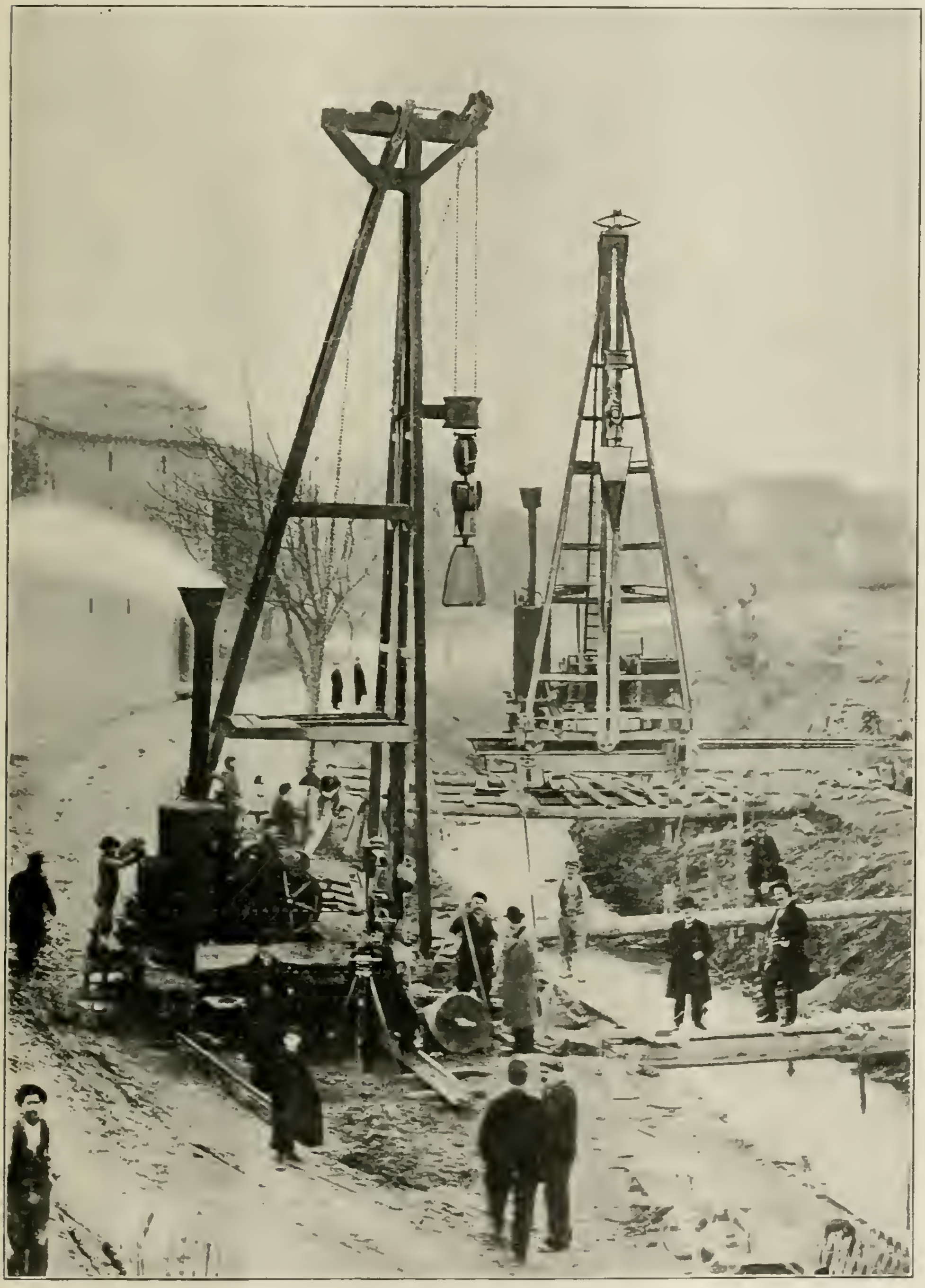

Fig. 2.—Bridge Abutment Foundation of Compressol Pillars at Avignon, France.

In considering the requirements that cement blocks should meet as a structural material, we must take into account the use in which they are to be put. We have in brick classification, the terra cotta brick, mud brick and dry pressed faced brick, and the hard burned, medium and light common brick; all of which find extensive and legitimate use, and yet vary widely in strength, fireproof qualities and appearance. The granites, limestones, sandstones and marbles are generally accepted in first-class construction, and yet differ greatly in weather and fire resisting qualities. Lumber, of course, is very combustible, and yet the different varieties show marked contrast in strength, durability and fire-resisting qualities, and we have to learn of any municipal requirement stipulating the kind of lumber for building construction. With these facts in mind, is it not fair to ask that some latitude be granted in the manufacture and use of cement blocks?

If an owner in most localities chooses to build the outside walls of his factory or residence of light burned common brick, showing an absorption of 30 per cent water who is there to say no? In fact, the average so-called hard burned brick will absorb from 20 to 22 per cent water and will pass muster under most municipal and architects' requirements; yet our leading muunicipal specifications require that cement blocks shall not exceed 15 per cent absorption, regardless of the use to which they are put.

Cement blocks may properly be used in substitution of other materials for: (1) Foundations; (2) exterior and superstructure walls carrying weight; (3) curtain walls, exterior and interior; (4) fire walls and partitions; (5) veneering; (6) retaining walls; (7) cornice, trim and ornamental work; (8) filler blocks for floor slabs; (9) chimney flues, etc., etc.

In this variety of work it is at once seen that uniformity and the highest quality is not required.

The writer, as chairman of the Committee on Tests of Cement and Cement Products of the National Association of Cement Users, recommended in his report, last January, that a Specification Committee be appointed by the association to draw up a standard specification and uniform instructions covering the manufacture of cement blocks, with the hope that this form, when prepared, might be offered to all the cities and leading towns in the United States for adoption. As a basis upon which to consider the standard specification and uniform instructions, my suggestions included the following, in part:

Cement. Only a true high-grade Portland cement, meeting the requirements and tests of the standard specifications of the American Society for Testing Materials shall be used in the manufacture of cement blocks for building construction.

Unit of Measurement. The barrel of Portland cement shall weigh 380 lbs. net, either in barrels or sub-divisions thereof, made up of cloth or paper bags, and a cubic foot of cement packed as received from the manufacturer, shall be called 100 lbs. or the equivalent of 3.8 cu. ft. per barrel. Cement shall be gaged or measured either in the original package as received from the manufacturer, or may be weighed and so proportioned; but under no circumstances shall it be measured loose in bulk, for the reason that when so measured it increases in volume from 20 to 33 per cent, resulting in a deficiency of cement.

Proportions. Owing to the different

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*Extracts from a paper by Mr. E. S. Larned, Civil Engineer, read before the Association of American Portland Cement Manufacturers, Sept. 11, 1907.

values of natural sand or fine crusher screenings for use in mortar mixtures, due not only to its mean effective size, but also to its physical characteristics, it is difficult to do more in a general specification than fix the maximum proportions of good sand that may be added to cement.

Sand, or the fine aggregate, shall be suitable silicious material passing the ¼-in. mesh sieve, and containing not over 10 per cent of clean, unobjectionable material passing the No. 100 sieve. A marked difference will be found in the value of different sands for use in cement mortar. This is influenced by the form, size and relative roughness of the surface of the sand grains, and the impurities, if any, contained. Only clean, sharp and gritty sand, graduated in size from fine to coarse and free from impurities, can be depended upon for the best results. Soil, earth, clay and fine "dead" sand are injurious to sand, and at times extremely dangerous; particularly in dry and semi-wet mortars, and they also materially retard the hardening of the cement. An unknown or doubtful sand should be carefully tested before use to determine its value as mortar ingredient. Screenings from crushed trap rock, granite, hard limestone and gravel stones are generally better than bank sand, river sand or beach sand in Portland cement mortars (but not so when used with natural cement, unless the very fine material be excluded). So-called clean, but very fine sand, has caused much trouble in cement work, and should always be avoided, of if impossible to obtain better, the proportion of cement should be increased. Stone screenings and sharp, coarse sand may be mixed with good results, and this mixture offers some advantages, particularly in making sand-cement blocks.

For foundations or superstructure walls exposed to weather, carrying not over 5 tons per sq. ft., the maximum proportion shall not exceed 4 parts sand to 1 part cement. This proportion, however, requires extreme care in mixing for uniform strength and will not produce water-tight blocks. We recommend for general work not over 3 parts sand, if well graded, to 1 part cement, and the further addition of from 2 to 4 parts of clean gravel stones passing the ¾-in. sieve and retained on a ¼-in. mesh sieve, or clean screened broken stone of the same sizes. These proportions, with proper materials and due care in making and curing, will produce blocks capable of offering a resistance to crushing of from 1,500 to 2,500 lbs. per sq. in. at 28 days. (For the best fireproof qualities limestone screenings or broken sizes should be excluded, but otherwise are all right for use.) Where greater strength is desired, particularly at short periods, from two to six weeks, we recommend the proportions of 1 part cement, 2 parts sand, and from 1½ to 3 parts gravel of broken stone of sizes above given. Blocks made of cement, sand and stone are stronger, denser, and consequently more waterproof than if made of cement and sand only, and are more economical in the quantity of cement used.

Mixing. The importance of an intimate and thorough mix cannot be overestimated. The sand and cement should first be perfectly mixed dry and the water added carefully and slowly in proper proportions, and thoroughly worked into and throughout the resultant mortar; the moistened gravel or broken stone may then be added either by spreading same uniformly over the mortar or spreading the mortar uniformly over the stones, and then the whole mass shall be vigorously mixed together until the coarse aggregate is thoroughly incorporated with and distributed throughout the mortar.

We recommend mechanical mixing wherever possible, but believe in the thorough mixing of cement and sand dry before the addition of water; this insures a better distribution of the cement throughout the sand, particularly for mortar used in machine made blocks of a semi-wet consistency. For fine materials, such as used in cement blocks, it is necessary that the mechanical mixer be provided with knives, blades or other contrivances to thoroughly break up the mass, vigorously mix the same and prevent balling or caking.

Curing. This is a most important step in the process of manufacture, second only to the proportioning, mixing and molding, and if not properly done will result either in great injury to or complete ruin of the blocks. Blocks shall be kept moist by thorough and frequent sprinkling, or other suitable methods, under cover, protected from dry heat or wind currents for at least seven days. After removal from the curing shed, they shall be handled with extreme care, and at intervals of one or two days shall be thoroughly wet by hose sprinkling or other convenient methods. We recommend curing in an atmosphere thoroughly impregnated with steam. This method serves to supply needed moisture, prevent evaporation, and in some measure accelerates the hardening of the blocks. We view with distrust, in the present knowledge of the chemistry of cement, any artificial, patented or mysterious methods of effecting the quick hardening of cement blocks or other cement products. If such method be proposed it should be thoroughly investigated by competent authority before use.

Time of Curing. This is also most important in its effect upon the industry, and is directly and vitally influenced by the following conditions: (1) Quality, quantity and setting properties of the cement used. (2) Quality, size and quantity of the sand or fine aggregate used. (3) Amount and temperature of water used. (4) Degree of thoroughness, with which the mixture is made. (5) Method of curing, weather conditions and temperature. (6) Density of the block as affected by the method and thoroughness of tamping or pressure applied.

Before fixing the minimum permissible time required in curing and ageing blocks, it is well to consider the important effect of additions of sand upon the tensile strength of cement mortar. The following tabulation has been interpolated from the diagram of cement mortar tests prepared by Mr. W. Purvis Taylor, of the Philadelphia Municipal Laboratories.

The results of the neat tests and the 1 to 3 mortar tests (i. e., one part cement to 3 parts crushed quartz, by weight) are averaged from over 100,000 tests, while the other results are based on from 300 to 500 tests.

Tensile Strength in lbs. per sq. in. of Portland Cement.

Proportions	7 dy.	28 dy.	2 mo.	3 mo.	4 mo.	6 mo.	12 mo.
Neat cement	710	768	760	740	732	758	768
1 to 1 mortar....	590	692	690	680	680	685	695
1 to 2 mortar....	370	458	460	455	453	458	460
1 to 3 mortar....	208	300	310	310	310	310	308
1 to 4 mortar....	130	210	230	230	230	232	232
1 to 5 mortar....	80	150	185	195	195	195	197

It must also be kept in mind that these results are obtained under practically uniform and theoretically correct conditions, in the amount of water used, thoroughness of mixing and moulding and storage of samples until tested Comparing the results at 28 days, it is apparent that the 1 to 5 mortar has only 71 per cent of the strength of the 1 to 4 mortar, and but 50 per cent of the strength of a 1 to 3 mortar. The 1 to 4 mortar has but 70 per cent of the strength of a 1 to 3 mortar and 46 per cent of the strength of a 1 to 2 mortar.

The ratio of compressive strength to tensile strength is not quite constant for all periods of time, and for the several mixtures above given; but the compressive strength, or resistance to crushing per square inch, may be approximately obtained by multiplying the tensile strength given in the above table by the constant 6. (Note. This would increase with the age of the mortar, and would be greater for good gravel or stone concrete than for the clear mortar of which a given concrete is made.)

In fixing the minimum time required for curing and ageing blocks before use, due regard should be given to the proportions used. It is manifestly wrong in principle to require as long a period for a 1 to 2 or a 1 to 3 block as might seem necessary for a 1 to 4 or a 1 to 5 block, and it is obviously unsafe to attempt to use a block of lean proportions in as short a time as a rich mixture would gain the necessary strength.

This might be supposed to be met by fixing the minimum resistance to crushing of blocks (of all compositions); but it must be kept in mind that a very small percentage of the blocks used are tested, by reason of the expense, inconvenience, or lack of facilities. The required minimum resistance to crushing of first-class blocks used for exterior and bearing walls should not be imposed upon blocks for minor and less important uses.

Marking. All cement blocks should be stamped (in process of making), showing name of manufacturer, date (day, month and year) made, and composition or proportions used. The place of manufacture, methods and materials should also be open to inspection by representative of the Building Department, the architect, engineer, or individual buyer.

There are good commercial reasons for permitting and encouraging this, as it would at once create confidence and add to the reputation of the block offered. No honest and progressive manufacturer would object. Quality and appearance will at once create a market for cement blocks at profitable prices, in most any location, and all this is of easy attainment.

Let the intending manufacturer of machine-made blocks remember that the machine is simply a mechanical convenience, and it remains for him to use proper materials, correct and accurate methods of proportioning, mixing, moulding and curing, to study and meet the demands of the building trade, and keep abreast and a little in advance of the other fellow in this progressive age.

The project for the Faucille-Geneva-Mont Blanc Ry. has been revived in Switzerland in conjunction with the proposed Mont Blanc Ry. The following is the route: A line from Lons-le Saunier, via the Faucille Pass to Heyerin, on the Geneva-Bellegrade Ry. This section would be 47 miles long, and have 24 miles of tunnels, the three longest being respectively 9.4 miles, 6.6 miles, and 4 miles long. Secondly, the Mont Blanc Ry. which would use the existing line from Geneva (Eaux Vives) to Chamonix and Aosta, via the Valley of the Arve to connect with the new line from Chamonix to Aosta, in the valley of the Po. The approximate distance to be traversed between Chamonix and Aosta, via the Valley of the Arve, Les Honches, Val Veni and Pre St. Didier is 46 miles, and there would be two tunnels, respectively 8 miles and 3 miles long. The estimated cost of the whole amounts to $55,000,000,000.

Contracts involving the expenditure of about $15,000,000 will be advertised this fall and winter by the Board of Water Supply of New York City, for work in connection with the new Catskill water supply. The contracts include the construction of the main dam, Kensico reservoir, the headworks of the Catskill Aqueduct, two portions of the aqueduct, the Rondout siphon and the Wallkill siphon.

The Atkinson, Topeka & Santa Fe Ry. is ported to have contracted for $2,500,000 worth of Ohia wood railroad ties to be delivered from Hawaii during the next five years.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Setting Electric Light Poles in Frozen Ground.

The following method was used in placing electric light poles in frozen ground: electric light poles in frozen ground: Steam obtained from the boiler of an ordinary traction engine was conveyed through a pipe to a vertical jet pipe, this latter being forced down into the earth. The jet pipe was connected by a tee to a horizontal pipe, 24 ins. long, capped at one end and connected at the other by nipples and four elbows to the steam pipe. The nipples and elbows were placed to allow the necessary play in handling the appliance. The jet pipe was manipulated by two wooden handles 10 ft. long, connected by stirrups to the two ends of the 24-in. horizontal pipe. The jet pipe was forced down by two men pressing on the handles, and as the earth thawed, the steam would carry the particles out alongside the pipe. As the depth increased more steam would be condensed in the bore hole, until finally the overflow was liquid mud. About 30 holes could be thawed in a 10-hour day. The ground thawed out was effected by frost to a depth of about 4 ft., although the really hard frozen ground was seldom over 2½ ft. deep.

Cost of Trenching, Pipelaying and Back-filling for Pipe Sewer Construction at Centerville, Iowa.

In constructing 8, 10, 12 and 15-in. pipe sewers at Centerville, Ia., careful records of cost were kept by Mr. M. A. Hall, Centerville, Ia., engineer in charge. From these records the following tables have been compiled. The work comprised 53 separate jobs, and the tables give the labor hours and cost per lineal foot for each class of labor for each job. Similarly detailed tables appeared in our issues of May 15, June 12, July 24, Aug. 21 and Sept. 18. Mr. Hall describes the methods of collecting the original data as follows:

"In the first place the account of the labor was kept by the inspector of the work and he had his instruction to be careful to account for all the men and where they worked. He was furnished with a blank and was required to turn these reports over to the engineer in charge each morning as he came on the work, of course turning in the report that covered the previous day's work. Together they would look over the report and make such corrections as might be necessary while the conditions were still fresh in mind. In this way what was considered to be an accurate account of the labor was obtained in a classified form so that by applying the wage per hour the daily cost could be easily obtained. However, no attempt was made to keep the actual cost for each day. It was kept rather by sections, as will be shown by the table to follow. Such other data as called for on the inspector's blanks were also obtained by the inspector each day. In but one or two instances did I have any trouble in getting accurate accounts from the inspectors, for, while it may seem strange to some, almost without exception the inspectors seemed to consider it a pleasure as well as a duty to take an interest in these reports. They received no compensation for this extra work. An important advantage in keeping the work by blocks or sections is evident, for in this way a good record could be kept of the kind of material excavated and its conditions relative to easy or difficult moving. This part of the data was largely kept by myself and from my personal observation.

"Of course, there are always labor costs to the contractor which do not come under the observation of the inspector, and it is hard for anybody except the contractor to know what these costs are, and many times he could not separate these incidental costs such as handling tools, unloading and hauling materials, moving materials from place to place in order to use up all odds and ends possible, and various other minor costs. Hence it is very possible that labor costs deduced from these figures should be increased by some percentage which I would estimate at 10 per cent for the average case."

The Japanese Government decided at a recent cabinet meeting to improve arrangements on various lines after the nationalization of railways is effected. The following enterprises are expected to be carried out for the five consecutive years from next fiscal year or before the opening of the great exposition of Japan, 1912, with about $75,000,000: Doubling lines (830 miles), $41,500,000; constructing 900 locomotives, $11,250,000; constructing 19,000 vans, $9,500,000; constructing 1,000 passenger cars, $5,000,000; extending and reconstructing stations, $7,500,000.

	JOB I		JOB II.		JOB III.		JOB IV.		JOB V		JOB VI.	
Size of pipe, ins	15		15		15		15		16		12	
Length of pipe, ft	385		221		206		446		216		271	
Average depth of trench, ft	6.5		7.7		8.9		9.0		3.5		7.7	
Width of trench, ins	36		36		36		36		36		24	
Excavation per lin. ft. of trench, cu. yds.	0.72		0.86		0.98		1.0		0.39		0.57	
TRENCHING:	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft	Total hours.	Cost per lin ft	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour.	412	$0.1926	135	$0.11	547	$0.4780	1107	$0.4468	90	$0.075	297	$0.1973
Total labor trenching	412	0.1926	135	0.11	547	0.4780	1107	0.4468	90	0.0750	297	0.1973
PIPELAYING:												
Pipelayer at 30 cts. per hour.	38	0.0296	20	0.0271	29	0.0422	85	0.0572	0		25	0.0277
Pipelayer's helpers at 17½ cts. per hour	76	0.0343	40	0.0317	58	0.0493	170	0.0667	96	0.0778	50	0.0323
Total labor pipelaying	114	0.0639	60	0.0588	87	0.0915	255	0.1239	96	0.0778	75	0.0600
GENERAL SERVICE:—												
Foreman at 35 cts. per hour.	65	0.0565	20	0.0317	70	0.1189	169	0.1326			32	0.0413
Water boy at 12½ cts. per hour	50	0.0162	20	0.0113	60	0.0352	100	0.280			30	0.0138
Total labor general service	115	0.0727	40	0.0430	130	0.1511	269	0.1606			62	0.0551
BACKFILLING:—												
By hand at 17½ cts. per hour			34	0.0269	27	0.0229	63	0.0247	5	0.0041	.	
Team and two men at 52½ cts. per hour			15	0.0356	14	0.0357	15	0.0177	10	0.0243	.	
Total labor backfilling			49	0.0625	41	0.0586	78	0.0424	15	0.0284	.	......
Grand total labor	641	0.3292	284	0.2743	805	0.7822	1709	0.7737	201	0.1812	434	0.3124
Labor cost per cu. yd. trenching	$0.2675		$0.1407		$0.4877		$0.4468		$0.1923		$0.3461	
Labor cost per cu. yd. backfilling	...		0.0727		0.0588		0.0424		0.0728		....	

	JOB VII.		JOB VIII.		JOB IX.		JOB X.		JOB XI.		JOB XII	
Size of pipe, ins	12		12		12		12		12		12	
Length of pipe, ft	446		309		221		272		595		246	
Average depth of trench, ft	8.2		8.2		8.6		9.6		10.7		11.0	
Width of trench, ins	24		24		24		24		24		24	
Excavation per lin. ft. of trench, cu. yds	0.6		0.6		0.64		0.71		0.8		0.82	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft
Trench diggers at 18 cts. per hour	792	$0.3196	336	$0.1957	298	$0.2427	469	$0.3104	1093	$0.3307	564	$0.4127
Total labor trenching	792	0.3196	336	0.1957	298	0.2427	469	0.3104	1093	0.3307	564	0.4127
PIPELAYING:—												
Pipelayer at 30 cts. per hour	64	0.0431	33	0.0320	25	0.0339	45	0.0496	72	0.0363	54	0.0659
Pipelayer's helpers at 17½ cts. per hour	128	0.0502	66	0.0374	48	0.0380	90	0.0579	145	0.0426	106	0.0754
Total labor pipelaying	192	0.0933	99	0.0694	73	0.0719	135	0.1075	217	0.0789	160	0.1413
GENERAL SERVICE:												
Foreman at 35 cts. per hour	105	0.0824	30	0.0340	10	0.0158	47	0.0605	78	0.0459	33	0.0470
Water boy at 12½ cts. per hour	105	0.0294	30	0.0121	10	0.0057	47	0.0216	78	0.0164	33	0.0167
Total labor general service	210	0.1118	60	0.0461	20	0.0215	94	0.0821	156	0.0623	66	0.0637
BACKFILLING:—												
By hand at 17½ cts. per hour	.	.....	....	.....	19	0.0151	50	0.0322	48	0.0141	107	0.0761
Team and two men at 52½ cts. per hour	.	.....	15	0.0255	16	0.0380	16	0.0309	9	0.0079	.	...
Total labor backfilling	....	......	15	0.0255	35	0.0531	66	0.0631	57	0.0220	107	0.0761
Grand total labor	1194	0.5247	510	0.3367	426	0.3892	764	0.5631	1523	0.4939	897	0.6938
Labor cost per cu. yd. trenching	$0.5327		$0.3262		$0.5792		$0.4372		$0.4134		$0.5033	
Labor cost per cu. yd backfilling	....		0.0425		0.0830		0.0889		0.0275		0.0928	

	JOB XIII.		JOB XIV.		JOB XV.		JOB XVI.		JOB XVII.		JOB XVIII	
Size of pipe, ins	10		10		8		8		8		8	
Length of pipe, ft	344		331		331		436		339		296	
Average depth of trench, ft	7.0		12.0		6.3		7.3		7.3		7.8	
Width of trench, ins	24		24		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds	0.52		0.9		0.43		0.5		0.5		0.53	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour.	156	$0.0816	863	$0.4693	281	$0.1528	485	$0.2002	348	$0.1848	218	$0.1326
Total labor trenching	156	0.0816	863	0.4693	281	0.1528	485	0.2002	348	0.1846	218	0.1326
PIPELAYING:												
Pipelayer at 30 cts. per hour	19	0.0166	53	0.0480	21	0.0190	23	0.0158	26	0.0230	19	0.0193
Pipelayer's helpers at 17½ cts. per hour	36	0.0183	106	0.0561	42	0.0222	46	0.0185	52	0.0268	38	0.0224
Total labor pipelaying	55	0.0349	159	0.1041	63	0.0412	69	0.0343	78	0.0498	57	0.0417
GENERAL SERVICE.—												
Foreman at 35 cts. per hour	19	0.0193	5	0.0053	21	0.0222	2	0.0016	30	0.0310	19	0.0225
Water boy at 12½ cts. per hour	19	0.0069	40	0.0151	12	0.0099	20	0.0057	30	0.0110	19	0.0081
Total labor general service	38	0.0262	45	0.0204	42	0.0301	22	0.0073	60	0.0420	38	0.0305
BACKFILLING.—												
By hand at 17½ cts. per hour	92	0.0468	....	... ...	14	0.0074	45	0.0181			4	0.0024
Team and two men at 52½ cts. per hour		.....	....	...	8	0.0127	9	0.0108			22	0.0390
Total labor backfilling	92	0.0468	....	... ..	22	0.0201	54	0.0289	.	.	26	0.0414
Grand total labor	341	0.1895	1067	0.5938	408	0.2442	630	0.2707	486	0.2766	339	0.2462
Labor cost per cu. yd. trenching	$0.1570		$0.5214		$0.3553		$0.4004		$0.3692		$0.2500	
Labor cost per cu. yd. backfilling	0.0900		....		0.0467		0.0578				0.0781	

Job 1: Good spading in black soil, small boulders, no pipe. Job 2: Fine easy spading, hauling 15-in. pipe 1½ miles, cost 1¼ ct. ft. Job 3: Good spading, 2 ft. hard pan in bottom, ditch caved, 16 ft. wide. Job 4: Good clay spading, 2 ft. shale in bottom; ditch caved bad. Job 5: Brick mason 10 hr., tenders 20 hr. on piers, plumbers 19 hr. at 60c per hr. Job 6: Easy clay spading 50 ft., wet ditch. Job 7: Easy spading, boulders in ditch, 13 yds. blasted rock. Job 8: Good spading in loam and clay, small rocks in ditch. Job 9: Filled ground, wet and caved badly. Job 10: Cavey ground, concreted pipe under bridge, 15 hrs., 1 1-3 yds. Job 11: Good clay spading, concreted pipe, 15 hrs. 1 1-3 yds. Job 12: Very easy clay spading, 50 ft., wet ditch, bad weather. Job 13: Fine soft spading, 25 ft., wet ditch, sandy bottom. Job 14: Good spading in sandy clay, dry ditch. Job 15: Easy spading in black swampy ground, 125 ft., wet. Job 16: Fine clay spading, 50 ft. wet ditch, sloppy backfilling. Job 17: Good clay spading, small rocks in ditch, 100 ft., wet. Job 18: Very fine clay spading, sandy bottom, 75 ft., wet.

	JOB XIX.		JOB XX.		JOB XXI.		JOB XXII.		JOB XXIII		JOB XXIV.	
Size of pipe, ins.	8		8		8		8		8		8	
Length of pipe, ft.	361		582		1700		276		546		186	
Average depth of trench, ft.	8.1		8.1		8.2		8.6		8.9		9.0	
Width of trench, ins.	22		22		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds.	0.55		0.55		0.56		0.58		0.64		0.61	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour	497	$0.2479	710	$0.2196	2460	$0.2605	318	$0.2074	708	$0.2334	259	$0.2507
Total labor trenching	497	0.2479	710	0.2196	2460	0.2605	318	0.2074	708	0.2334	259	0.2507
PIPELAYING:—												
Pipelayer at 30 cts. per hour.	31	0.0258	35	0.0180	138	0.0244	28	0.0304	32	0.0176	15	0.0242
Pipelayer's helpers at 17½ cts. per hour	62	0.0300	68	0.0205	276	0.0284	56	0.0355	64	0.0205	30	0.0282
Total labor pipelaying	93	0.0558	103	0.0385	414	0.0528	84	0.0659	96	0.0381	45	0.0524
GENERAL SERVICE:—												
Foreman at 35 cts. per hour	35	0.0329	31	0.0186	170	0.035	1	0.0013	0	...	0	..
Water boy at 12½ cts. per hour	35	0.0121	31	0.0067	170	0.0125	20	0.0090	30	0.0069	20	0.0134
Total labor general service	70	0.0450	62	0.0253	340	0.0475	21	0.0103	30	0.0069	20	0.0134
BACKFILLING:—												
By hand at 17½ cts. per hour	7	0.0034	31	0.0093	225	0.0232	26	0.0165	26	0.0083	7	0.0066
Team and two men at 52½ cts. per hour	33	0.0480	22	0.0198	119	0.0267	4	0.0076	20	0.0192	5	0.0141
Total labor backfilling	40	0.0514	53	0.0291	344	0.0599	30	0.0241	46	0.0275	12	0.0207
Grand total labor	700	0.4001	928	0.3125	3558	0.4207	453	0.3077	880	0.3059	336	0.3372
Labor cost per cu. yd. trenching	$0.4507		$0.3993		$0.4652		$0.3576		$0.3047		$0.4110	
Labor cost per cu. yd. backfilling	0.0935		0.0529		0.1089		0.0415		0.0430		0.0339	

	JOB XXV.		JOB XXVI.		JOB XXVII.		JOB XXVIII.		JOB XXIX.		JOB XXX.	
Size of pipe, ins.	8		8		8		8		8		8	
Length of pipe, ft.	296		690		415		359		222		396	
Average depth of trench, ft.	9.0		9.1		9.1		9.2		9.3		9.5	
Width of trench, ins.	22		22		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds.	0.61		0.62		0.62		0.63		0.63		0.65	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour.	407	$0.2475	855	$0.2231	914	$0.3964	415	$0.2081	289	$0.2343	473	$0.2150
Total labor trenching	407	0.2475	855	0.2231	914	0.3964	415	0.2081	289	0.2343	473	0.2150
PIPELAYING:—												
Pipelayer at 30 cts. per hour.	35	0.0355	55	0.0239	56	0.0405	46	0.0384	25	0.0338	24	0.0182
Pipelayer's helpers at 17½ cts. per hour	70	0.0413	110	0.0279	112	0.0472	92	0.0449	50	0.0394	48	0.0212
Total labor pipelaying	105	0.0768	165	0.0518	168	0.0877	138	0.0833	75	0.0732	72	0.0394
GENERAL SERVICE:—												
Foreman at 35 cts. per hour	40	0.0473	59	0.0299	30	0.0253	42	0.0409	4	0.0063	30	0.0265
Water boy at 12½ cts. per hour	40	0.0169	59	0.0107	50	0.0151	42	0.0146	20	0.0113	30	0.0095
Total labor general service	80	0.0642	118	0.0406	80	0.0404	84	0.0555	24	0.0176	60	0.0360
BACKFILLING:—												
By hand at 17½ cts. per hour	10	0.0059	..	.. ..	130	0.0548	34	0.0166	8	0.0063	11	0.0049
Team and two men at 52½ cts. per hour	13	0.0231	. .	......	15	0.0190	42	0.0614	11	0.0260	31	0.0411
Total labor backfilling	23	0.0290	. .	......	145	0.0738	76	0.0780	19	0.0323	42	0.0460
Grand total labor	615	0.4175	1138	0.3155	1307	0.5983	713	0.4249	407	0.3574	647	0.3364
Labor cost per cu. yd. trenching	$0.4057		$0.3598		$0.6390		$0.3303		$0.3719		$0.3308	
Labor cost per cu. yd. backfilling	0.0475		......		0.1190		0.1238		0.0513		0.0708	

	JOB XXXI.		JOB XXXII.		JOB XXXIII.		JOB XXXIV.		JOB XXXV.		JOB XXXVI.	
Size of pipe, ins.	8		8		8		8		8		8	
Length of pipe, ft.	429		411		1290		391		371		578	
Average depth of trench, ft.	9.5		9.5		9.6		9.6		9.7		9.8	
Width of trench, ins.	22		22		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds.	0.64		0.64		0.65		0.65		0.66		0.66	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour.	484	$0.2031	636	$0.2786	2099	$0.2929	532	$0.2449	515	$0.2498	995	$0.3099
Total labor trenching	484	0.2031	636	0.2786	2099	0.2929	532	0.2449	515	0.2498	995	0.3099
PIPELAYING:—												
Pipelayer at 30 cts. per hour.	32	0.0224	30	0.0219	115	0.0267	28	0.0215	45	0.0364	56	0.0291
Pipelayer's helpers at 17½ cts. per hour	64	0.0261	60	0.0255	230	0.0312	56	0.0251	90	0.0424	112	0.0339
Total labor pipelaying	96	0.0485	90	0.0474	345	0.0579	84	0.0466	135	0.0788	168	0.0630
GENERAL SERVICE:—												
Foreman at 35 cts. per hour	35	0.0285	30	0.0256	14	0.0380	28	0.0251	45	0.0424	6	0.0036
Water boy at 12½ cts. per hour	35	0.0102	30	0.0091	115	0.0111	28	0.0089	45	0.0152	50	0.0108
Total labor general service	70	0.0387	60	0.0347	129	0.0491	56	0.0340	90	0.0576	56	0.0144
BACKFILLING:—												
By hand at 17½ cts. per hour	31	0.0126	13	0.0055	31	0.0042	29	0.0130		..		....
Team and two men at 52½ cts. per hour	29	0.0355	19	0.0243	84	0.0342	21	0.0282	26	0.0368	41	0.0372
Total labor backfilling	60	0.0481	32	0.0298	115	0.0384	50	0.0412	26	0.0368	41	0.0372
Grand total labor	710	0.3384	818	0.3905	2688	0.4383	722	0.3667	766	0.4230	1260	0.4245
Labor cost per cu. yd. trenching	$0.3173		$0.4350		$0.4513		$0.3768		$0.3747		$0.4649	
Labor cost per cu. yd. backfilling	0.0751		0.0466		0.0591		0.0634		0.0552		0.0558	

Job 19: Spading in hard clay, small boulders. Job 20: Very soft easy spading in loam and clay, dry ditch. Job 21: One-half hard digging, small boulders in ditch, 5 yds. blasted. Job 22: Very easy spading in yellow clay, 100 ft. wet ditch. Job 23: Close to street car track, but good clay spading, bottom wet. Job 24: Hard clay spading, dry, no boss. Job 25: Close to street car track, clay spading hard, dry ditch. Job 26: Good spading, 100 ft. wet and sandy, all sheated tight. Job 27: Dipping waterd 60 hr., 174 ft. lumber left, 50 ft. quicksand. Job 28: Good clay spading, but hard and dry. Job 29: Good clay spading, sand, dry bottom. Job 30: Good clay spading, dry and hard, muddy backfilling. Job 31: Good clay spading, 100 ft. wet ditch, crowded quarters. Job 32: Good yellow clay spading, hard and dry. Job 33: Good spading in clay, hard and dry under trees. Job 34: Moderate clay spading, dry bottom. Job 35: Close to street car track but good clay work, car track across street. Job 36: Close to street car track, good spading, under switch.

	JOB XXXVII.		JOB XXXVIII.		JOB XXXIX.		JOB XL.		JOB XLI.		JOB XLII.	
Size of pipe, ins	8		8		8		8		8		8	
Length of pipe, ft	369		441		221		907		352		446	
Average depth of trench, ft	9.9		10.0		10.0		10.0		10.1		10.1	
Width of trench, ins	22		22		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds.	0.67		0.68		0.68		0.68		0.68		0.68	
TRENCHING:	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour	627	$0.3059	686	$0.2800	277	$0.2256	1244	$0.2469	521	$0.2664	964	$0.3891
Total labor trenching	627	0.3059	686	0.2800	277	0.2256	1244	0.2469	521	0.2664	964	0.3891
PIPELAYING:												
Pipelayer at 30 cts. per hour	33	0.0268	35	0.0238	18	0.0244	81	0.0268	39	0.0332	66	0.0444
Pipelayer's helpers at 17½ cts. per hour	66	0.0313	70	0.0278	36	0.0285	162	0.0312	78	0.0388	132	0.0518
Total labor pipelaying	99	0.0581	105	0.0516	54	0.0529	243	0.0580	117	0.0720	198	0.0962
GENERAL SERVICE:												
Foreman at 35 cts. per hour	33	0.0313	4	0.0032	3	0.0047	79	0.0305	5	0.0050	62	0.0487
Water boy at 12½ cts. per hour	33	0.0112	35	0.0099	15	0.0085	79	0.0109	35	0.0124	62	0.0168
Total labor general service	66	0.0425	39	0.0131	18	0.0132	158	0.0414	40	0.0174	124	0.0655
BACKFILLING:												
By hand at 17½ cts. per hour	28	0.0133	...	......	...	....	38	0.0073	104	0.0517	10	0.0039
Team and two men at 52½ cts. per hour	24	0.0341	27	0.0321	13	0.0309	38	0.0220	2	0.0030	28	0.0330
Total labor backfilling	52	0.0474	27	0.0321	13	0.0309	76	0.0293	106	0.0547	38	0.0369
Grand total labor	844	0.4539	857	0.3768	362	0.3226	1721	0.3756	784	0.4105	1324	0.5877
Labor cost per cu. yd. trenching	$0.4589		$0.4118		$0.3318		$0.3631		$0.3918		$0.5722	
Labor cost per cu. yd. backfilling	0.0717		0.0472		0.0454		0.0431		0.0804		0.0542	

	JOB XLIII.		JOB XLIV.		JOB XLV.		JOB XLVI.		JOB XLVII.		JOB XLVIII.	
Size of pipe, ins	8		8		8		8		8		8	
Length of pipe, ft	376		371		221		79		493		351	
Average depth of trench, ft	10.1		10.3		10.4		10.4		10.6		10.6	
Width of trench, ins	22		22		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds.	0.68		0.7		0.7		0.7		0.73		0.73	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour	570	$0.2427	356	$0.1727	389	$0.3168	131	$0.2985	936	$0.3417	475	$0.2436
Total labor trenching	570	0.2427	356	0.1727	389	0.3168	131	0.2985	936	0.3417	475	0.2436
PIPELAYING:—												
Pipelayer at 30 cts. per hour	31	0.0247	29	0.0251	27	0.0366	9	0.0342	60	0.0365	25	0.0214
Pipelayer's helpers at 17½ cts. per hour	62	0.0289	58	0.0273	54	0.0428	18	0.0399	120	0.0426	50	0.0249
Total labor pipelaying	93	0.0536	87	0.0524	81	0.0794	27	0.0741	180	0.0791	75	0.0463
GENERAL SERVICE:—												
Foreman at 35 cts. per hour	40	0.0372	29	0.0197	.	......	...		33	0.0234	25	0.0204
Water boy at 12½ cts. per hour	40	0.0133	29	0.0098	25	0.0142	5	0.0079	50	0.0127	25	0.0089
Total labor general service	80	0.0505	58	0.0295	25	0.0142	5	0.0079	83	0.0361	50	0.0293
BACKFILLING:—												
By hand at 17½ cts. per hour	47	0.0219	13	0.0062	....	..	23	0.0509	...	.....	20	0.0100
Team and two men at 52½ cts. per hour	31	0.0433	22	0.0311	....		12	0.0798	23	0.0245	24	0.0359
Total labor backfilling	78	0.0652	35	0.0373	......	..	35	0.1307	23	0.0245	44	0.0459
Grand total labor	821	0.4120	536	0.2919	495	0.4104	198	0.5112	1222	0.4814	644	0.3651
Labor cost per cu. yd. trenching	$0.3569		$0.2467		$0.4526		$0.4264		$0.4861		$0.3337	
Labor cost per cu. yd. backfilling	0.0959		0.0533		....		0.1867		0.0336		0.0629	

	JOB XLIX.		JOB L.		JOB LI.		JOB LII.		JOB LIII.	
Size of pipe, ins	8		8		8		8		8	
Length of pipe, ft	358		361		261		437		352	
Average depth of trench, ft	10.7		10.8		10.8		11.5		11.6	
Width of trench, ins	22		22		22		22		22	
Excavation per lin. ft. of trench, cu. yds.	0.73		0.73		0.73		0.78		0.8	
TRENCHING:—	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.	Total hours.	Cost per lin. ft.
Trench diggers at 18 cts. per hour	546	$0.2746	768	$0.3829	387	$0.2669	776	$0.3197	934	$0.4776
Total labor trenching	546	0.2746	768	0.3829	387	0.2669	776	0.3197	934	0.4776
PIPELAYING:—										
Pipelayer at 30 cts. per hour	30	0.0251	51	0.0424	31	0.0356	60	0.0411	67	0.0571
Pipelayer's helpers at 17½ cts. per hour	60	0.0293	102	0.0494	62	0.0416	120	0.0481	134	0.0666
Total labor pipelaying	90	0.0544	153	0.0918	93	0.0772	180	0.0892	201	0.1237
GENERAL SERVICE:—										
Foreman at 35 cts. per hour	30	0.0293	....	......	30	0.0416	60	0.0481	1	0.0010
Water boy at 12½ cts. per hour	50	0.0175	50	0.0172	30	0.0143	60	0.0171	60	0.0213
Total labor general service	80	0.0468	50	0.0172	60	0.0559	120	0.0652	61	0.0223
BACKFILLING:—										
By hand at 17½ cts. per hour	....	.....	32	0.0155	38	0.0255	27	0.0108	...	.....
Team and two men at 52½ cts. per hour	...	....	36	0.0524	30	0.0603	4	0.0048	.	......
Total labor backfilling	....	....	68	0.0679	68	0.0858	31	0.0156	....	......
Grand total labor	716	0.3758	1039	0.5598	608	0.4858	1107	0.4896	1196	0.6236
Labor cost per cu. yd. trenching	$0.3762		$0.5245		$0.3656		$0.4099		$0.5970	
Labor cost per cu. yd. backfilling	....		0.0930		0.0901		0.0200		....	

Job 37: Ditch caved badly, close to old water pipe ditch. Job 38: Close to street car track, but easy spading in clay. Job 29: Very easy clay spading, dry. Job 40: Easy clay spading, dry ditch, 100 ft., rainy weather. Job 41: Easy clay spading, but tight quarters. Job 42: Very hard digging, all pick work, dry ditch. Job 43: Good clay digging dry and hard, 33 ft. street. Job 44: Good clay spading, hard and dry, 33 ft. street. Job 45: Easy spading in clay ground. Job 46: Easy spading in sandy clay, muddy backfilling. Job 47: Close to street car track, under reversed curve, dry. Job 48: Good digging in sand and clay, 10 ft. wet. Job 49: Good clay spading, but hard and dry. Job 50: Hard clay spading, men dissatisfied over pay. Job 51: Easy clay spading, dry and sandy bottom. Job 52. Easy spading in sandy clay, 50 ft. very wet sand. Job 53: Hard clay, pick work, men drinking; no boss.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Florida East Coast Railway, Key West Extension.

BY HOWARD EGLESTON*, C. E.

III—TEMPORARY TRESTLE WORK.

It was not intended originally to use trestle work to any considerable extent in constructing this road, but after spending many thousands of dollars and many months time in unsuccessful effort to make fine mud "stay put" in swiftly running water, the consulting engineer was forced to change his plans and erect, for temporary use, many thousands of feet of trestle work.

The first trestle of any importance was erected at Tavernier Creek, where a nearly completed earth embankment had been swept away by a storm. A description of the trestle built at this point will answer for all this work as the only variable is the length of supports. Yellow pine piles 10 to 14 ins. in diameter are driven 12 ft. apart longitudinally and 10 ft. transversely. In driving piles in the coral rock found almost everywhere on this work, it is found necessary to first punch a hole in the rock. This is done by using a steel punch which is placed in the leads of the pile driver and driven into the stone from 3 to 5 ft., according to the hardness of the rock. The pile is then placed over the hole and driven as far as it will go. In building the trestles, 12x12 in. caps are drift-bolted to the piles; the stringers are 12x12 ins. and 6x12 ins. in diameter by 12 to 13 ft. long. These are placed alternately, one span having the 12x12 in. timber, the next span having two 6x12 in. timbers placed on edge and lapping on each side of the 12x12 in. On top of the stringers are bolted 8x8 in. ties, to which are spiked the rails, and outside of the rails guard timbers are well bolted to the ties; 4x8-in., 4x10-in. and 42x12-in. is used for bracings shown in cuts. While this is a very light construction it has given a satisfactorily solid structure for use of construction trains, and it is not intended that it shall be used for passenger trains, the plan being to make solid rock fills, where the trestles now stand, before the road is taken over by the Operating Department. The piles driven thus into the coral rock are very solid and there is no chance of their sinking under any weight that may be placed on them, but they are very easily broken off; there is no "give" to them and a blow which would not injure a pile driven into an earth bottom, snaps these piles off like matches. This will be a serious matter in case of a severe storm, as floating equipment would work destruction in short order. Similar trestles were built at Snake Creek (Fig. 1) 900 ft. long. At Windley's Passage 2,700 ft. long, and at Matecumbe Opening trestle has been used in many ways to supplement the work done by the dredges, at several places where on account of the swift current, there was lack of material for the dredges. As shown in Fig. 2, bed pieces were put down and low trestles erected, so that work trains could be run out on it and the embankment completed with stone. At another place a trestle 1,500 ft. long was built on top of the embankment that had been thrown up by the dredges, as it was found impossible to build the embankment as high as necessary with the dredges. When raised above a certain height great sections would slide back into the ditch or the saturated mud on which the embankment was constructed would "squash" out into the ditch. This trestle, parts of which are shown in Fig. 3, formed a grade leading to the high level at which the Indian Key draw bridge must be placed. Work had been carried on here for many months to stop the current and form an embankment that would stand, but without success; it was, therefore, finally determined to build the trestle and later on make the necessary fill of rock.

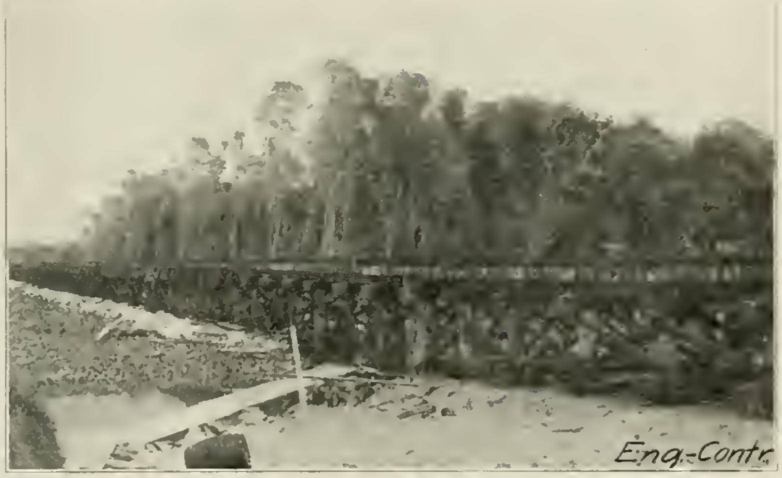

Fig. 1.—Trestlework on Swampy Shore of Plantation Key at Snake Creek.

The company has been very fortunate, in that for this trestle work it had Mr. C. S. Coe as Engineer of Bridge Construction. Mr. Coe is not only a good bridge builder, but he is also a good manager of men and an "everlasting hustler." These qualities have enabled him, under most discouraging conditions, to keep his trestles well ahead of the track, and materially to aid in hastening the completion of the road to Long Key.

EMBANKMENTS IN WATER.

The first long embankment to be started was that between Upper and Lower Matecumbe Keys—about two miles in length. A persistent attempt was here made to construct a high and at the same time narrow embankment by means of an hydraulic dredge. The ordinary process of forcing mud and water through a pipe to the point of deposit being impracticable, the settling basin not being large enough, a combination of dipper and hydraulic dredge was used. The material being taken from the bottom by means of the dipper, was dumped into a hopper in the hold of the machine, and at stated intervals was forced from this hopper by steam pressure, through a pipe to the place of deposit. This plan required much less water than the ordinary form of suction dredge, still so much was used of necessity, that the material was kept in a saturated condition. The rate of construction was so slow and unsatisfactory that the hydraulic process has been entirely abandoned and the suction dredges are used now solely for filling in the ditches from whence material was taken for the embankment.

The practice now is for a dredge, with a short boom, to cut a ditch about 30 ft. from center line of road, throwing the material excavated on the center line to form the embankment. At a convenient distance behind this dredge, another one with a longer boom, will widen the ditch and build the embankment to grade when the material excavated permits. When it is impossible to make the material stand up, it has been necessary to put in temporary trestles and complete the grade with stone. A great deal of time and money has been spent in trying to stop up the deeper channels found in the openings between the Keys. Where there was a deposit of silt or sand, the dredges threw up the embankment very quickly, but in the channels where the water is deeper and runs swiftly, all material for an embankment has been carried away and the dredges have nothing to build with. Under these circumstances the practice has been to drive down two rows of piles spaced 10 ft. apart, and 12 ft. in the row. To these piles are fastened aprons as shown in Fig. 3. Against these aprons spoil is thrown by a suction dredge located at a distance when material is plenty. This has proved a very unsatisfactory process, for the tide which rises nearly 2 ft. would scour out the material about as fast as the dredge could place it. Between Upper and Lower Matecumbe only one out of the five channels, and that the smallest one, was stopped up in this way after months of work, during which time the suction dredges deposited sand for hundreds of feet on each side of the right of way, finally diverting the waters into the next channel. Afterward a dipper dredge built the embankment with the material thus placed by the suction dredges. Theoretically, the original plan would have stopped up these channels for very little money. Actually the process was very expensive. A few lighter loads of stone deposited in the channel would have done in a week what it took months to accomplish, or better still, a concrete wall 1 ft. thick and rising just above high water mark could have been built against the piles to stop the current, after which the suction dredge could have deposited the material near by without waste.

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*Chattanooga, Tenn.

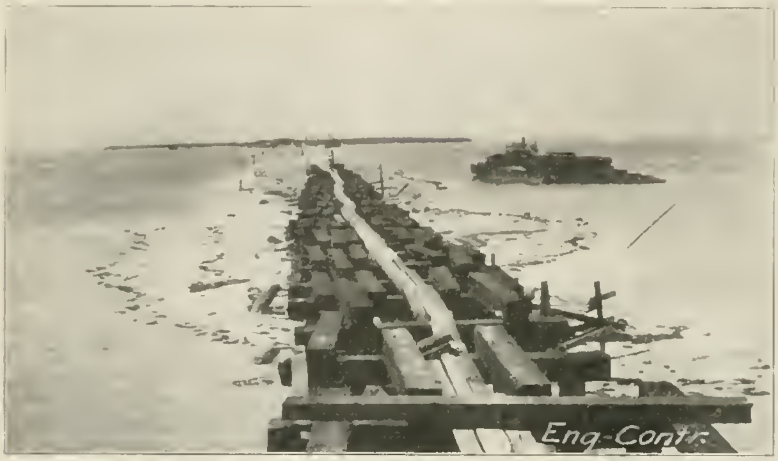

Fig. 2.—Trestle Between Upper and Lower Matecumbe.

(Low trestle made necessary by lack of material nearby for building up to grade.)

The embankment in the opening between Lower Matecumbe and Long Key is made of coral and shell sand, which stands up much better than the silt found largely at Matecumbe opening, just described, but on the other hand it scours away badly. As the building of the embankment advances the openings for the passage of water decrease in size, this causes the water to rush along beside the embankment seeking an outlet, washing away in its passage, a great deal of material from the embankment. At least three times the amount of material required for this embankment has been handled by the dredges.

Among the Keys, from Big Price Key to Key West, there is very little deposit of sand or silt, it will therefore be necessary, when filling between these keys, either to trestle across them and carry the rock for the fill on cars, or drill and blast the rock under water near the line of embankment, placing it in position by means of dredges or floating excavators. This drilling is generally done by negroes who are given 40 to 50 ft. of hole as a day's work or "task," they being allowed to go to their quarters whenever their task is done, which is usually soon after noon. An effort was made to raise the task to 60 ft. on easy drilling, but all the men quit, and went to Key West. After that "hoboes" were employed on this work, but, as they had not come to Florida looking for hard work, which drilling in water certainly is, they worked at it but a short time and the excavators were constantly delayed for lack of drilling. The only place on the line where modern methods were applied to this class of work was at Key West by the contractor for the terminal work, Mr. Howard Trumbo, who had a floating steam drilling outfit at work which easily kept ahead of the big dipper dredge "Grampus." Had such mechanical drilling outfits been provided for each excavator the work would have progressed much more rapidly and economically.

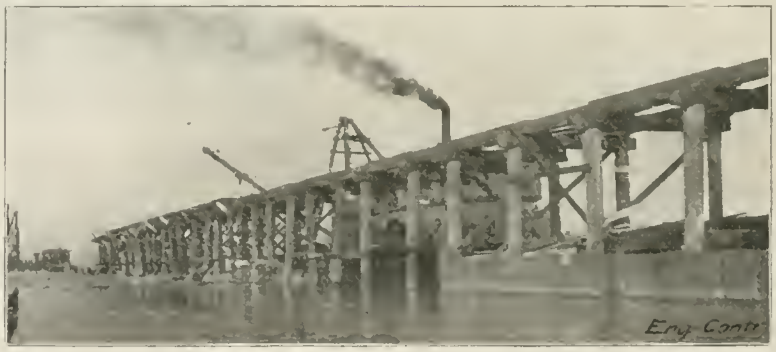

Fig. 3.—Trestle Between Upper and Lower Matecumbe.

(Trestle built high on account of draw bridge which was placed in gap at left hand.)

Profiting by the experience of the earthquake and fire in Kingston, Jamaica, in January last, that city has got out a new building law which provides that in the future, so far as possible, earthquake-proof and fire-resisting buildings only shall be erected. Some of the requirements are as follows: The framework of buildings may be of steel, iron, or wood, every member securely, rigidly and durably connected with every contiguous member, and must be covered externally with hard, durable, and fire-resisting material, securely attached to the framing at all points. No timber-framed building shall contain more than two stories having an aggregate height of 25 ft., or have a cubical content exceeding 100,000 cu. ft., nor shall any timber-framed building be erected or used for any other than residential purposes. All members of a steel or iron framework of any building shall be of the same material, and no cast iron shall be used in any part thereof. The walls of buildings may be constructed of brick, concrete, stone, or other hard and incombustible material, and they must be built on a foundation of cement concrete. Walls built of brick, dressed stone, or other similar material must be solidly put together with Portland cement mortar, and be re-enforced by hoop or band iron not less than 1 in. wide and 1/20th of an inch thick. Walls of cement concrete shall be composed of Portland cement, clean sand, and clean broken brick or stone, and shall be re-enforced by steel or iron bands, bars, or wires. Roofs must be covered externally with hard, durable, and incombustible material.

In 1894 the length of the standard gage railways of Germany was 27,407 miles; in 1904 the length was 33,594 miles.

Methods and Costs; Some Old; Some New.

Filing Drawings.—The following method of filing drawings is used at the United States Engineer's office, at Sterling, Ill.: The tracings are numbered consecutively, beginning with No. 1. The number is placed in a circle with the number of the tracing placed above a horizontal line through the center of the circle, and the number of the drawer or pigeon hole in which the tracing is filed is placed below the line. A record of the tracing, giving a description of the drawing, number of tracing, number of drawer where filed, size, scale and date of drawing, name of draftsman, and any special notes, is placed in a book kept for that purpose. A similar record is placed on an index card and filed in a card cabinet. The cards are filed under the number of the structure or the part of the work to which they refer, the cabinet being divided into the heads noted below: Locks, Aqueducts, Culverts, Highway Bridges, Railroad Bridges, Dams, Miles, Office, Miscellaneous, etc. For instance, a drawing for a bridge over the end of a lock is indexed under "Locks," "Highway Bridges," and under the individual number of the locks and bridges, where such bridges occur.

Cofferdam Without Interior Bracing.—A cofferdam built to avoid interior bracing was used in the construction of the masonry work of a bridge pier. The pier was located at a point where the water was 28 ft. deep, the bottom of the site being practically level with about 3½ ft. of sand, mud and clay overlying rock. The cofferdam was a double wall polygon of 12 sides, the walls being 4 ft. apart in the clear, within which puddle was placed. The free working space was about 42½ ft. in diameter. The walls of the dam were built up of square hemlock timbers halved into each other at their intersections and proportioned under the consideration of a horizontal polygonal arch, subjected to a uniform load of water due to the head at any point. Bolts and round struts of barked pieces of piles were used at intervals to tie the walls together, the round struts being adopted so as to allow the puddle as shoveled in to run around them freely. The bolts passed through clamp timbers of 6x12-in. yellow pine the whole depth of the dam. These clamps were scarfed in two lengths, for convenience in building. The interior struts butted against pieces of 6-in. plank, so as to catch all the wall timbers. The dam was built on shore in launching ways for about one-third its height and was then towed to the site and built up until it grounded in position. A line of cotton lamp wick was introduced between each course of timber and at the scarfing of the joints, and made the seams quite water tight. The courses of timber were drift bolted every 3 ft. with ⅞x18-in. bolts and the scarfed corners were additionally fastened with 10x⅝-in. spikes. The dam required 140 M. ft. B M. of timber, 15,000 lbs. of iron and 600 cu. yds. of puddle.

Repairing Broken Water Main.—Part of the water supply of the town of Berryville, Va., is obtained from a reservoir 2½ miles distant in the Blue Ridge mountains. This reservoir has an elevation of about 400 ft. and the water is piped by gravity to the town, the main crossing the Shenandoah river at a point where it is 600 ft. wide. Recently this main was broken at the river crossing by a "water hammer," the break being located about 250 ft. from shore in 6½ ft. of water. The piece broken out of the side of the pipe was 30 ins. long and 8 ins. wide.

In order to get at the pipe it was necessary to construct a cofferdam. Accordingly a frame work 5 ft. wide by 12 ft. long and 7 ft. high was made of 2-in. plank. This framework was made in four pieces, two ends and two sides, the ends having a groove for the sides to fit into. Heavy iron hooks and eyes were placed at the four corners at top and bottom of this framework. Another framework, 11 ft. wide by 18 ft. long, was constructed in the same way. The frameworks were constructed on the banks of the river, taken apart and floated to position, where they were set up around the broken pipe, one inside the other. The 3-ft. space between the inner and outer frames was filled with good potters' clay and well puddled and stamped to the bottom of the river. A number of iron hooks and eyes held the frames together and prevented their spreading. The water was then pumped out of the inner space by two 4-in. sheet iron pumps, and the bottom of the river and the broken pipe exposed. The joint containing the break was cut out and a new joint inserted, good hot lead being used in making the joints. To keep the lead hot a fire was made on a pile of clay on a flat boat which had been constructed to carry the clay for the cofferdam. The work was done under the superintendence of Mr. D. G. Adelsberger, Hydraulic Engineer, Baltimore, Md.

Macadam Road Costs.—Some interesting data in the construction of macadam roads in Massachusetts are given in a recent bulletin prepared by Austin B. Fletcher, secretary Massachusetts Highway Commission, and issued by the U. S. Office of Public Roads. According to this the average costs to the state of Massachusetts of broken stone in place on state highways constructed in 1906 were as follows: For a road made of imported stone (trap rock), 6 in. deep at center and 4 in. deep at sides, the cost per ton in place was $1.956; the cost per square yard in place was $0.6245 and the cost per mile was $5,496. One ton of stone made 3.13 sq. yds. of macadam. For a road made of imported stone (traprock) 4 ins. deep throughout, the cost per ton in place was $2.025; the cost per square yard in place was $0.5393 and the cost per mile was $4,746. One ton of stone made 3.76 sq. yds. of macadam. For a road made of local stone 6 ins. deep at center and 4 ins. deep at sides, the cost per ton in place was $1.396; the cost per square yard in place was $0.4201 and the cost per mile was $3,696. One ton of stone made 3.32 sq. yds. of macadam. For a road made of local stone 4 ins. deep throughout, the cost per ton in place was $1.583; the cost per square yard in place was $0.3931 and the cost per mile was $3,459. One ton of broken stone made 4.03 sq. yds. of macadam. The above costs per mile are equated on the basis of a road 15 ft. wide. The average contract prices for the several construction items exclusive of macadam were as follows:

Excavation per cu. yd	$ .4352
Borrow per cu. yd	.5622
Ledge excavation per cu. yd	1.78
Cement concrete masonry, cu. yd.	8.85
Shaping road for broken stone per sq. yd	.0281
Vit. 18-in. clay pipe, in place, per lin. ft	1.57
Vit. 12-in. clay pipe, in place, per lin. ft	.7662
Vit. 10-in. clay pipe, in place, per lin ft	.6430
Vit. 8-in. clay pipe, in place, per lin. ft.	.5700
Iron water pipe, 12 in., in place, per lin ft	2.20
Iron water pipe, 18 in., in place, per lin. ft	3.75
Stone filling for V drains, in place, per cu. yd	.8271
Guard rail, in place, per lin. ft	.2770
Catch basins, in place (including catch basin frames and grates), each	35.74
Setting stone bounds	1.85

The price for cement concrete masonry does not include the cement or the steel reinforcement, which may be estimated at about $3 additional. The average wages per 9-hour day for part of 1906 and for an 8-hour day for the remainder of the year were as follows:

Ordinary labor	$1.75 to $2.00
Crusher and roller engineers.	3.00 to 3.50
Foreman	3.00 to 5.00
1-horse wagon and driver	3.00 to 4.00
2-horse wagon and driver	4.50 to 5.50

In 1904 there were 2,151,570 miles of public roads in the United States.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0396. **Feed Water Heaters.**—The American Incline Filter & Heater Company, Marion, Ohio.

This is an unusually well gotten up descriptive catalog relating to the advantages of feed water heating and the special merits of the feed water heaters manufactured by the firm named. Questions of what design of heater offers greatest economy, oil separation, etc., are discussed. Drawings and illustrations are given showing the application of the system of heating and purification controlled by this company.

No. 0397. **Labor Saving Specialties.**—Walter Macleod & Company, Cincinnati, Ohio.

The labor saving specialties illustrated and briefly described in this catalog include torches, flue welding machines, locomotive tire expanders, painting machines, rivet forges, sand blast machines, weed burners, white-washing machines, etc. Each of these various devices is illustrated and given a brief description. Prices and capacities are also stated.

No. 0398. **Oil Filters and Ventilator Heads.** The Burt Manufacturing Company, Akron, Ohio.

This is an unusually handsome descriptive catalog. The first portion of the catalog, comprising nearly fifty pages, is devoted to presenting the merits of the various types of oil filters manufactured by the company; the remainder describes and illustrates the well-known Burt ventilators. The text of the catalog is descriptive in the best sense of the word in trade publications. The several devices are shown by sectional drawings, their operation is described, and a full explanation is given of the features which are considered to be especially meritorious in their construction. Anyone at all interested in either of the classes of apparatus mentioned will do well to secure this catalog and preserve it.

No. 0399. **Well Drilling Machinery.**—The Crown Drilling Machine Company, Akron, Ohio.

The two pamphlets received from this company describe and illustrate the company's general line of well drilling tools and also its special drilling machines for drilling blast holes. Each of the various machines is illustrated and described briefly. Statements are given of the apparatus composing complete well drilling plants of various sizes. The pamphlet on the use of well drillers for drilling blast holes should be of particular interest to contractors as it contains not only a description of the construction and operation of the machines, but also a large number of hints regarding the method of conducting such work.

No. 0400. **Concrete Mixers.**—The International C. Fireproofing Company, Columbus, Ohio.

The mixer shown in this pamphlet is known as the American mixer. It consists of a drum within which works a revolving shaft carrying knives or blades which perform the mixing operation. The pamphlet contains a large number of testimonial letters from general contractors, railway companies, building block manufacturers, contractors for reinforced concrete work, paving contractors, and others, speaking favorably of the results obtained from the American mixers used by them. Sizes, capacities and weights of the several machines turned out by the company are given.

No. 0401. **Blocks**. Boston & Lockport Block Company, Boston, Mass.

This is a general catalog of the products of the above named firm which has been well known for a great many years as one of the principal manufacturers of blocks and sheaves in the United States. Illustrations, descriptions and tables of dimensions, capacities and cost of all the various sizes and patterns of block are given. The company also describes a special frictionless, non-chokable, diaphragm pump for contractors' use. Several claims are made for the superior construction of this pump, and the catalog is well worth obtaining by contractors for the information which it gives regarding this important machine.

No. 0402. **Incandescent Vapor Gas Lamps.**—The Best Light Company, Canton, Ohio.

This company makes lamps, street lights, and torches burning gas produced within the lamp itself from common gasoline. For contractors, the portion of the catalog which is of principal interest is that describing street lamps and torches. The various patterns of these lights are described and illustrated and such data are given regarding each pattern as will suffice to give a clear understanding of its capacity and lighting efficiency. The company makes a special claim of the perfection of construction of its lamps and of their absolute safety.

No. 0403. **Chains.**—The Hayden-Corbett Chain Company, Columbus, O.

This company manufactures chains for all purposes and also sprocket wheels, grooved sheaves, etc., used for chain transmission of power. Special attention is paid to the construction of dredging chains and chains for heavy hoisting work. Each style of chain is illustrated and has given sizes, strength and price. All chains turned out are thoroughly tested, the company having at its plant a special chain testing machine with a capacity of 300,000 lbs. for determining the strength of its product.

No. 0404. **Hoisting Engines.**—The John F. Byers Machine Co., Ravenna, Ohio.

This is a general descriptive catalog and price list of the various hoisting machinery for contract work made by the company named above. The machines described include hoisting engines, elevators for building work, winches and derricks of various kinds. There are also shown a large line of derrick fittings and contractors' supplies for derricks and other hoisting devices. The catalog will prove useful to contractors as a book of reference when they have occasion to buy hoisting machinery.

No. 0405. **Paving Brick.**—The Metropolitan Paving Brick Company, Canton, Ohio.

This is an unusualy well written and well printed pamphlet describing the manufacture and use of brick and block paving. The pamphlet opens with a general discussion of the advantages of brick as a paving material, and follows with a description of the company's plant at Canton, Ohio, giving in detail the various processes required in the manufacture of paving brick from the time the raw material is taken from the clay pits until the finished brick is turned out. There is a section relating to tests of paving brick, and following this are a number of testimonial letters and general catalog information regarding the product of the company.

No. 0405. **Reinforcement for Concrete.**—Goff, Homer & Co., Pittsburg, Pa.

This little pamphlet illustrates and describes briefly but very clearly the Cummings system of reinforced concrete. Descriptions and illustrations are given of beam reinforcement, the Cummings hooped column, and of the patent chair lock used in connection with the system.

No. 0406. **Direct Current Motors and Generators.**—Allis-Chalmers Company, Milwaukee, Wis.

This pamphlet is a book of directions for the installation of direct current motors and generators. Drawings are given showing the various parts of the several machines, and these are accompanied by a complete set of rules covering all parts of the work of installation.

No. 0407. **Portland Cement.**—Chicago Portland Cement Co., Chicago, Ill.

This is a handsomely printed collection of half-tone views of buildings, bridges, tunnels, water towers, tanks and reservoirs, sewers and other structures in which "Chicago A A" Portland cement has been used. The several structures shown are briefly described by captions.

No. 0408. **Steam Pumps and Hydraulic Machinery.**—The Canton-Hughes Pump Co., Canton, O.

This firm handles a full line of simplex and duplex pumping machinery for boiler feed, fire, elevator, ice plant, mine, factory and general service. There are several styles and sizes of pumps illustrated in this pamphlet, which also gives tables of sizes, capacities and prices.

No. 0409. **Turret Lathes.**—Niles-Bement-Pond Co., New York, N. Y.

The Pond rigid turret lathe described in this pamphlet is designed for producing work ordinarily done on engine lathes, and is especially adapted for such work as gear wheels, fly-wheels, and gas engine cylinders. It can also be used for heavy bar work, such as wrist pins and projectiles. Two sizes, 21 and 28-in., are regularly built. The pamphlet describes the construction and operation of the lathe and illustrates work done with it.

Personals.

Mr. R. S. Davis has been appointed Terminal Engineer of the Mexican Central Ry., at El Paso, Tex.

Mr. E. T. Bond has been appointed Chief Engineer of the Arkansas, Louisiana & Gulf Ry., with headquarters at Bastrop, La.

Mr. Wilbur T. Wilson, of 71 High St., Woburn, Mass., has been appointed Assistant Engineer Designer to the Board of Water Supply of New York City.

Fred. H. Dewey has resigned his position as Assistant Engineer in the Bureau of Buildings, Manhattan Borough, New York City.

Mr. W. C. Groves, of Macon, Ga., has accepted a position on the engineering staff engaged in the Key West extension of the Florida East Coast Ry.

Fort Pitt Bridge Works of Pittsburg, Pa., have opened an office in the Fisher Bldg., Chicago, Ill. Mr. A. R. Young, C. E., is in charge of the office.

Mr. John Schulz, for a number of years with the American Bridge Co., has been appointed Assistant City Engineer of Seattle, Wash. He will have charge of the bridge work of the city.

Mr. Alfred W. Arenander, of 137 East 218th St., Williamsbridge, New York City, has been appointed Assistant Engineer Designer to the Board of Water Supply of New York City.

Mr. E. E. Stone, Assistant Chief Engineer of the Boston & Albany R. R., has been appointed Engineer of Maintenance of Way and Construction, with headquarters at Springfield, Mass.

Messrs. William F. Bixby and Arthur B. White have formed a partnership under the firm name of Bixby & White, and have opened offices in the San Fernando Bldg., Los Angeles, Cal. They will make a specialty of structural steel and reinforced concrete construction, irrigation and sewerage systems.

Mr. Clarence W. Hubbell has resigned his position as Civil Engineer to the Water Commissioners of Detroit, Mich., and will go to Manila, P. I., to take entire charge of the water system at that city. He will be succeeded at Detroit by Mr. Geo. H. Fenkel, at present Civil Engineer of the Water Department of Erie, Pa.

Mr. Richard K. Meade, Chemist for the Dexter Portland Cement Co., and Editor of the Chemical Engineer, has opened a testing laboratory at Nazareth, Pa. A specialty will be made of the manufacture, testing and analysis of Portland cement and its raw materials. Mr. Clarence E. Kline will be the manager of the laboratory.

Mr. John S. Branne has opened an office at 1 Madison Ave., New York City, where he will engage in practice as a consulting engineer, making a specialty of bridges, buildings and general structural work. Mr. Branne was formerly Secretary and Chief Designing Engineer of the James E. Brooks Co., Consulting Engineers, New York City.

Mr. Wm. H. Arnold, formerly Chief Engineer of the Bush Terminal Co., of Brooklyn, N. Y., and Mr. Harold S. Andrew, until recently identified with the U. S. Engineer Department in the improvement of New York Harbor and adjacent waters, have opened offices at 52 Broadway, New York City, under the firm name of Arnold & Andrew, Consulting Engineers. They will specialize in designing dredges, water front improvements, etc.

Mr. Thomas Wheeler has resigned his position as Division Superintendent of the canals for the Middle Division of the New York State Barge Canal. He is succeeded by Mr. Charles C. Barrett, Division Superintendent of the Western Division, the latter being succeeded by the promotion of Mr. Oscar H Peacock, inspector in the State Department of Public Works. Mr. Wheeler's resignation is due to his receiving the Republican nomination for Mayor of Utica, N. Y.

Mr. Walter B. Snow, M. AM. Soc. M. E., for many years in charge of the Publicity Department of the B. F. Sturtevant Co., has opened an office at 170 Summer St. Boston, Mass., where he will engage in general practice as a Publicity Engineer. Mr. Snow is a graduate of Massachusetts Institute of Technology and has had much experience in engineering work and as a teacher, lecturer, and contributor to the technical press. He is the author of Steam Boiler Practice, and (in connection with the B. F. Sturtevant Co.) of the Treatise on Mechanical Draft.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Oct. 17. Fort Logan Roots, Ark....Sept. 25
Oct. 17. Media, Pa. ....Oct. 16
Oct. 18. Caldwell, Idaho ....Oct. 9
Oct. 18. Brooklyn, N. Y....Oct. 16
Oct. 19. Canton, China ....Sept. 4
Oct. 21. Richmond, Va. ....Oct. 16
Oct. 21. River Falls, Wis....Oct. 16
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Oct. 21. Los Angeles, Cal....Oct. 16
Oct. 22. Hamilton, O. ....Oct. 2
Oct. 22. Bismarck, N. Dak....Oct. 16
Oct. 23. Akron, O. ....Oct. 16
Oct. 23. Philadelphia, Pa. ....Oct. 16
Oct. 24. Washington, D. C....Oct. 2
Oct. 26. Chicago, Ill. ....Oct. 9
Oct. 26. Eaton, O. ....Oct. 16
Oct. 28. Sulphur Springs, Ind. T...Oct. 16
Oct. 30. Toledo, O. ....Oct. 16
Oct. 30. Williamsport, Md. ....Oct. 16
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Nov. 5. Millvale, Pa. ....Oct. 16
Nov. 12. Troy, O. ....Oct. 16
Nov. 15. Glendive, Mont. ....Oct. 2

Buildings.

Oct. 16. Springfield, O. ....Sept. 18
Oct. 16. Harrisburg, Pa. ....Sept. 25
Oct. 16. Polk, Pa. ....Oct. 2
Oct. 16. Harrisburg, Pa. ....Oct. 2
Oct. 16. Baltimore, Md. ....Oct. 9
Oct. 16. Chicago, Ill. ....Oct. 9
Oct. 16. Sheldon, Ia. ....Oct. 9
Oct. 17. Peoria, Ill. ....Sept. 11
Oct. 17. Fort McPherson, Ga....Sept. 25
Oct. 17. Brooklyn, N. Y....Oct. 9
Oct. 18. Montenallo, Ala. ....Sept. 18
Oct. 18. Denver, Colo. ....Sept. 25
Oct. 18. Fort Monroe, Va....Oct. 9
Oct. 18. Fort Totten, N. Y....Oct. 9
Oct. 18. Lansing, Mich. ....Oct. 9
Oct. 18. Fort Wood, N. Y. H....Oct. 16
Oct. 19. Glen Cove, N. Y....Oct. 9
Oct. 20. Hot Springs, Ark....Oct. 2
Oct. 20. Washington, Kan. ....Oct. 9
Oct. 21. Des Moines, Ia....Sept. 11
Oct. 21. Milwaukee, Wis. ....Sept. 18
Oct. 21. Richmond, Va. ....Oct. 16
Oct. 21. Newark, N. J....Oct. 16
Oct. 21. New Orleans, La....Oct. 16
Oct. 21. New York, N. Y....Oct. 16
Oct. 21. Brooklyn, N. Y....Oct. 16
Oct. 22. Secaucus, N. J....Sept. 25
Oct. 22. Kansas City, Mo....Oct. 16
Oct. 22. Milwaukee, Wis. ....Oct. 16
Oct. 22. Warren, Pa. ....Oct. 16
Oct. 24. Lapeer, Mich. ....Oct. 9
Oct. 24. Washington, D. C....Oct. 9
Oct. 24. Lacey, Ia. ....Oct. 9
Oct. 24. Washington, D. C....Oct. 9
Oct. 24. Brooklyn, N. Y....Oct. 16
Oct. 25. Winston-Salem, N. C....Oct. 9
Oct. 25. Raleigh, N. C....Oct. 16
Oct. 26. Kansas City, Mo....Oct. 16
Oct. 28. East St. Louis, Ill....Oct. 2
Oct. 28. Plattsburg Barracks, N. Y.Oct. 9
Oct. 28. Salem, Ind. ....Oct. 16
Oct. 30. Terre Haute, Ind....Sept. 18
Oct. 30. Atlanta, Ga. ....Sept. 25
Oct. 30. Columbus, O. ....Oct. 2
Oct. 31. Cleveland, O. ....Oct. 2
Oct. 31. Kansas City, Mo....Oct. 9
Nov. 1. St. Croix Falls, Wis....Oct. 16
Nov. 4. Fort Washington, Md....Oct. 9
Nov. 4. Pierre, S. Dak....Oct. 16
Nov. 5. Bloomfield, Ind. ....Sept. 18
Nov. 5. Bloomfield, Ind. ....Sept. 25
Nov. 5. Flint, Mich. ....Oct. 2
Nov. 5. Portland, Me. ....Oct. 9
Nov. 5. New Orleans, La....Oct. 16
Nov. 6. Luverne, Ala. ....Oct. 16
Nov. 9. Las Animas, Colo. ....Sept. 25
Nov. 11. Pensacola, Fla. ....Oct. 16
Nov. 12. Pipestone, Minn. ....Oct. 16
Nov. 11. New Orleans, La....Oct. 16
Nov. 12. Seattle, Wash. ....Oct. 16
Nov. 15. Chippewa Falls, Wis....Oct. 9
Nov. 21. New Orleans, La....Oct. 9

Roads and Streets.

Oct. 16. Toledo, O. ....Oct. 9
Oct. 16. Brooklyn, N. Y....Oct. 9
Oct. 16. St. Joseph, Mich....Oct. 9
Oct. 17. West Seneca, N. Y....Oct. 9
Oct. 17. Kansas City, Mo....Oct. 9
Oct. 17. Carterville, Mo. ....Oct. 9
Oct. 17. Fort Wayne, Ind....Oct. 9
Oct. 17. Dubuque, Ia. ....Oct. 16
Oct. 17. Harrisburg, Pa. ....Oct. 16
Oct. 18. Toledo, O. ....Oct. 16
Oct. 18. Indianapolis, Ind. ....Oct. 16
Oct. 18. Lincoln, Ill. ....Oct. 16
Oct. 19. Woodsfield, O. ....Oct. 9
Oct. 19. Nampa, Idaho ....Oct. 9
Oct. 19. Quincy, Ill. ....Oct. 16
Oct. 19. Chicago, Ill. ....Oct. 16
Oct. 21. Logansport, Ind. ....Sept. 25
Oct. 21. Montrose, Colo. ....Oct. 9
Oct. 21. Philadelphia, Pa. ....Oct. 16
Oct. 21. Albany, N. Y....Oct. 16
Oct. 21. St. Paul, Minn....Oct. 16
Oct. 21. New York, N. Y....Oct. 16
Oct. 21. Michigan City, Ind....Oct. 16
Oct. 21. Goshen, Ind. ....Oct. 16
Oct. 22. Scranton, Pa. ....Oct. 16
Oct. 22. Buffalo, N. Y....Oct. 16
Oct. 22. Logansport, Ind. ....Oct. 16
Oct. 23. Brooklyn, N. Y....Oct. 16
Oct. 23. Butler, Pa. ....Oct. 16
Oct. 24. Concord, N. C....Oct. 16
Oct. 24. Kansas City, Mo....Oct. 16
Oct. 24. Fort Wayne, Ind....Oct. 16
Oct. 26. Richwood, O. ....Oct. 9
Oct. 30. Cleveland, O. ....Oct. 16
Oct. 31. Fort Logan H. Roots, Ark..Oct 9
Nov 4. Peru, Ind. ....Oct. 2
Nov. 4. Salem, Ind. ....Oct. 16
Nov. 4. Jasper, Ind. ....Oct. 16
Nov. 5. Millvale, Pa. ....Oct. 16
Nov. 7. Rockville, Ind. ....Oct. 16
Nov. 12. Troy, O. ....Oct. 16

Sewers.

Oct. 17. West Seneca, N. Y....Oct. 9
Oct. 17. Decatur, Ill. ....Oct. 16
Oct. 17. Dubuque, Ia. ....Oct. 16
Oct. 18. Scranton, Pa. ....Oct. 16
Oct. 18. Altoona, Pa. ....Oct. 16
Oct. 18. Enid, Okla. ....Oct. 16
Oct. 19. Chicago, Ill. ....Oct. 16
Oct. 19. Cloquet, Minn. ....Oct. 16
Oct. 19. Quincy, Ill. ....Oct. 16
Oct. 21. Steubenville, O. ....Oct. 9
Oct. 21. Brainerd, Minn. ....Oct. 9
Oct. 21. Michigan City, Ind....Oct. 16
Oct. 21. Sherman, Tex. ....Oct. 16
Oct. 21. Albany, N. Y....Oct. 16
Oct. 21. St. Paul, Minn....Oct. 16
Oct. 21. Aurora, Ind. ....Oct. 16
Oct. 21. Burlington, Ia. ....Oct. 16
Oct. 21. Jasper, Ala. ....Oct. 16
Oct. 22. Spokane, Wash. ....Oct. 9
Oct. 22. Buffalo, N. Y....Oct. 9
Oct. 22. Virginia, Minn. ....Oct. 16
Oct. 23. Whiterocks, Utah ....Sept. 25
Oct. 24. Kansas City, Mo....Oct. 16
Oct. 24. Cedar Rapids, Ia....Oct. 16
Oct. 28. Aberdeen, S. Dak....Oct. 9
Oct. 29. Tecumseh, Mich. ....Oct. 16
Nov. 5. Millvale, Pa. ....Oct. 16
Dec. 3. Auburn, N. Y....Oct. 16

Water Supply.

——— Bicknell, Ind. ....Oct. 16
Oct. 19. Chicago, Ill. ....Oct. 16
Oct. 21. Swanton, O. ....Oct. 16
Oct. 22. Marion, Kan. ....Oct. 2
Oct. 22. Beaver City, Neb....Oct. 9
Oct. 23. Atlanta, Ga. ....Sept. 18
Oct. 25. De Pere, Wis....Oct. 16
Nov. 4. Tucson, Ariz. ....Oct. 2
Nov 5. New Fort Lyon, Colo....Oct. 9
Nov. 7. Chilocco, Okla. ....Oct. 16
Nov. 12. Pipestone, Minn. ....Oct. 16
Nov. 15. Phoenix, Ariz. ....Oct. 2
Dec. 1. Phoenix, Ariz. ....Oct. 16
Dec. 17. Camden, N. J....Oct. 16

Miscellaneous.

Oct. 16. Baltimore, Md., Garbage Disposal, Oct. 9
Oct. 17. Brooklyn, N. Y., Masonry Wall, Oct. 9
Oct. 17. Brooklyn, N. Y., Masonry Walls, Etc., Oct. 9
Oct. 18. Lions Head, Ont., Wharf Extension, Oct. 9
Oct. 18. San Jose, Cal., Chimney, Oct 9
Oct. 18. Reading, Pa., Subway, Oct. 16
Oct. 19. Lancaster, O., Riprap, Oct. 9
Oct. 19. Fort Greble, R. I., Wharf Repairs, Oct. 9
Oct. 21. Louisville, Ky., Steel Barges, Sept. 25
Oct. 23. Baltimore, Md., Street Lighting, Oct. 16
Oct. 23. Brooklyn, N. Y., Wood Fences, Oct. 16
Oct. 24. New York, N. Y., Signal System, Oct. 9
Oct. 24. Toccoa, Ga., Concrete Work, Oct. 9
Oct. 24. New York, N. Y., Train Signals, Oct. 16
Oct. 24. Kansas City, Mo., Tree Planting, Oct. 16
Oct. 25. Charleston, S. C., Dredge, Sept. 25
Oct. 26. Salmon River, N. B., Breakwater Extension, Oct. 16
Oct. 28. Atlantic City, N. J., Boardwalk, Oct. 16
Oct. 29. Cincinnati, O., Track Work, Oct. 2
Oct. 31. Mobile, Ala., Snagboat, Sept. 11
Oct. 31. New York, N. Y., Ferry House, Oct. 16
Nov. 1. Harrisburg, Pa., Stone Removal, Oct. 16
Nov. 1. Fort Schuyler, N. Y., Wharf Work, Oct. 16
Nov. 4. Louisville, Ky., Snagboat Hull, Oct. 9
Nov. 4. Fort D. A. Russell, Wyo., Steel Fence, Oct. 16
Nov. 8. Kokomo, Ind., Electric Lighting, Oct. 9
Nov. 8. Kokomo, Ind., Electric Plant, Oct. 16
Nov. 14. New Orleans, La., Monument, Oct. 16
Nov. 15. Charleston, S. C., Street Lighting, Sept. 11
Nov. 18. Dallas, Tex., Lock and Dam, Oct. 16
Nov. 20. New Orleans, La., Dredge, Oct. 2
Nov. 25. Mobile, Ala., Locks and Dams, Oct. 2

Excavation, Earth and Rock.

Oct. 16. Des Moines, Ia., Filling, Oct. 2
Oct. 17. Albany, N. Y., Dredging, Sept. 25
Oct. 19. Marinette, Wis., Ditch Work, Oct. 9
Oct. 21. Wilmington, Del., Dredging, Oct. 2
Oct. 21. Long Prairie, Minn., Ditch Work, Oct. 16
Oct. 21. St. Paul, Minn., Dredging, Oct. 16
Oct. 22. St. Paul, Minn., Dredging, Sept. 25
Oct. 22. New Orleans, La., Canal, Oct. 2
Oct. 24. Ortonville, Minn., Ditch, Oct. 16
Oct. 25. Ivanhoe, Minn. Ditch Work, Sept. 25
Oct. 30. Newport, R. I., Dredging, Oct. 9
Nov. 7. New Boston, Ill., Ditch and Levee Work, Oct. 16
Nov. 20. Detroit, Mich., Dredging, Oct. 16

Materials, Machines, Supplies, Tools, Etc.

Oct. 16. Ottawa, Ont., Asphalt Plant, Oct. 2
Oct. 16. Baltimore, Md., Motor, Oct. 9
Oct. 16. Atlanta, Ga., Boiler, Oct. 9
Oct. 17. New York, N. Y., Lumber, Paint, Etc., Oct. 9
Oct. 21. Louisville, Ky., Dump Scows, Sept. 25
Oct. 21. Chicago, Ill., Cement, Oct. 2
Oct. 21. Helena, Mont., Fire Hose, Oct. 2
Oct. 21. Washington, D. C., Pumps, Picks, Shovels, Etc., Oct. 2
Oct. 21. Pontiac, Mich., Boiler, Oct. 16
Oct. 22. Philadelphia, Pa., Boilers, Pumps, Etc., Oct. 9
Oct. 22. Mare Island, Cal., Blower, Oct. 9
Oct. 22. Milwaukee, Wis., Fire Hose, Oct. 16
Oct. 23. New York, N. Y., Nozzles, Tools, Oct. 16
Oct. 23. Brooklyn, N. Y., Portland cement, Oct. 16

Oct. 23. Owosso, Mich., Boilers, Oct. 16
Oct. 24. New York, N. Y., Electrical Equipment, Oct. 16
Oct. 24. New York, N. Y., Broken Stone, Screenings, Oct. 16
Oct. 28. Washington, D. C., Castings, Rope, Etc., Oct. 9
Oct. 29. Puget Sound, Wash., Timber, Tubing, Etc., Oct. 9
Oct. 29. Mare Island, Cal., Drills, Cable, Etc., Oct. 9
Oct. 31. Cleveland, O., Mechanical Equipment, Oct. 2
Nov. 4. Washington, D. C., Tanks, Meters, Etc., Oct. 9
Nov. 4. Washington, D. C., Tools, Meters, Etc., Oct. 9
Nov. 8. Washington, D. C., Pumps, Cement, Etc., Oct. 16
Nov. 15. Winnipeg, Man., Water Pipe, Oct. 9
Dec. 1. Phoenix, Ariz., Water Pipe, Oct. 16

BIDS ASKED.

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Los Angeles, Cal.—Until 2 p. m., Oct. 21, by C. G. Keyes, County Clerk, for construction of concrete culvert on Las Virgenes Road.

Los Angeles, Cal.—Until 2 p. m., Oct. 21, by C. G. Keyes, County Clerk, for constructing pile trestle bridge on Telegraph road to Santa Fe Springs.

Sulphur Springs, Ind. T.—Until 10 a. m., Oct. 28, by the Superintendent of Platt National Park, for constructing a suspension foot bridge at Bromide Springs in Platt Park.

Williamsport, Md.—Until noon, Oct. 30, by Washington & Berkeley Bridge Co., Edw. W. Byron, Secy., Williamsport, for constructing a reinforced concrete arch bridge, 15 spans, total length, 1,570 ft., over Potomac River at this point. Mason D. Pratt, Consulting Engineer, Harrisburg, Pa.

Brooklyn, N. Y.—Until 2 p. m., Oct. 18, by John H. O'Brien, Commissioner Water Supply, Gas and Electricity, 13 Park Row, New York, for furnishing, delivering and constructing piers for two bridges over the Wantagh stream, and to do certain grading of Seaman's road, in the town of Hempstead. Surety required is $3,000.

Bismarck, N. Dak.—Until 10 a. m., Oct. 22, by I. W. Healy, County Auditor, for construction of steel I-beam bridge, 30-ft. span, 18-ft. roadway, over Long Lake Creek.

Akron, O.—Until 10 a. m., Oct. 23, by Mark D. Buckmann, County Auditor, for constructing bridge over Tuscarawas River in Franklin Township.

Eaton, O.—Until 1:30 p. m., Oct. 26, by C. W. Cidson, County Auditor, for constructing bridge over Elkhorn Creek in Jackson Township.

Ashland, O.—Until Nov. 4, by E. B. Westover, County Auditor, for constructing sub and superstructure for 45-ft. steel bridge in Clearcreek Township.

Toledo, O.—Until Oct. 30, for construction of two concrete abutments for bridge over Ten Mile Creek, in Washington Township.

Troy, O.—See Under Bids Asked—Roads and Streets.

Media, Pa.—Until noon, Oct. 17, by E. S. Hickman, Clerk County Commissioners, for constructing reinforced concrete bridge over Cobb's Creek in Haverford Township.

Millvale, Pa.—Until Nov. 5, by Borough Clerk, for constructing bridge over Girty Run.

Philadelphia, Pa.—Until noon, Oct. 23, by Director of Public Works, for the construction of the 12th St. bridge on the line of the Pennsylvania R. R., at Cambria St, and also the Wyoming St. bridge, which is to cross Frankford Creek with two spans. Plans, etc., with Chief Engineer Board of Surveys, Room 416, City Hall.

Richmond, Va.—Until 9 a. m., Oct. 21, by Supervisors of Hanover and Henrico Counties, at office of State Highway Commissioner, Capitol Building, for construction of reinforced concrete bridge over Chickahominy River over road between Richmond and Ashland, Va.

River Falls, Wis.—Until Oct. 21, by A. P. Weld, City Clerk, for steel arch bridge, with sidewalk and cement floor over Kinnickinnic River at Cedar St.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Luverne, Ala.—Until 10 a. m., Nov. 6, by F. M. T. Tankersley, Judge of Probate, for construction of fireproof jail. E. J. Ostling, Architect, Birmingham, Ala.

Pensacola, Fla.—Until 3 p. m., Nov. 11, by James Knox Taylor, Supervising Architect, Washington, D. C., for plumbing and sewerage at Santa Rosa Quarantine Station, Pensacola.

Salem, Ind.—Until 7:30 p. m., Oct. 28, by School Trustees, for erection of joint-graded high school building, and for installation of heating and ventilating systems. Plans, etc., with E. F. Routh.

Indianapolis, Ind.—Trustees Hillside Ave. Christian church are reported to be receiving bids for erection of new church on Ingram St. Louis H. Gibson is Architect.

Gary, Ind.—Pittsburg Wine Co., Braddock, Pa., is reported to be calling for bids for erection of 3-story office and theater building here.

New Orleans, La.—Until noon, Oct. 21, by Board of Administrators of the Charity Hospital for the erection and entire completion of a 6-story fireproof hospital, to be known as the Delgado Memorial, in the city of New Orleans, La. Plans and specifications may be obtained of the architects, Crosby & Henkel, 706 Morris Building, New Orleans.

Gary, Ind.—Charles T. Savage, Joliet, Ill., is said to be calling for bids for erection of 2-story store and office building in Gary.

New Orleans, La.—Until 1 p. m., Nov. 11, by City Engineer, for erection of city hall annex building.

New Orleans, La.—Until 11 a. m., Nov. 5, by Col. F. L. Denny, Q. M., Marine Corps, Washington, D. C., for the construction at naval station, New Orleans, La., of marine barracks and officers' quarters. DeBuys, Churchill & LaBouisse, Architects, 817 Hibernia Bank Bldg., New Orleans, La.

Pipestone, Minn.—Until 2 p. m., Nov. 12, by Commissioner of Indian Affairs, Washington, D. C., to construct and complete a stone warehouse with gasoline gas piping, a stone hospital with plumbing, steam heat and gasoline gas piping, and a tank and tower. Further information may be obtained from Willard S. Campbell, Superintendent, Pipestone.

Kansas City, Mo.—Until 2 p. m., Oct. 22, by Everett Elliott, Secy. Bd. Pub. Wks., for building addition to clay market house. Edwards & Sunderland, Architects, 559 Sheidley Bldg.

Kansas City, Mo.—Until 2 p. m., Oct. 26, by Everett Elliott, Secy. Bd. Pub. Wks., for general contract for furnishing work on General Hospital, 24th and Locust Sts., Root & Siemens, Architects, 701 Postal Bldg.

Brooklyn, N. Y.—Until 2:30 p. m., Oct. 21, by Robert W. Hebberd, Commissioner of Charities, foot of E. 26th St., New York, for complete remodelling of the present annex building, and for the erection and entire completion of two additions to Kings County Hospital. Surety required is $35,000.

Brooklyn, N. Y.—Until 3 p. m., Oct. 21, by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., New York, for installing heating and ventilating apparatus in addition to Public School 80; security required is $2,000. Bids are also asked for installing heatig and ventilating apparatus in Public School 129; security required is $10,000.

New York, N. Y.—Until 3 p. m., Oct. 21, by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., for the following work: Erection of outside iron stairs at Public Schools 8, 28, 67, 80 and 127; installing heating and ventilating apparatus in three public schools; installing electric equipment in two public schools.

Raleigh, N. C.—Until noon, Oct. 25, by W. A. Erwin, Chairman Building Committee, West Durham, N. C., for construction of a 4-story brick addition to the State Hospital for the Insane at Raleigh, N. C., also separate bids for plumbing and heating. Barrett & Thomson, Architects, Raleigh, N. C.

Newark, N. J.—Until noon, Oct. 21, by R. Heber Breitnall, Adjt. Gen. State House, Trenton, for erection of armory for the First Troop at Newark. Plans, etc., with Commissioner of Charities, State House, Trenton.

Fort Wood, N. Y. H.—Until 11:30 a. m., Oct. 18, by G. C. Burnell, Constructing Q. M., for furnishing and installing storm sash for new barrack and wireless telegraph station at this post.

Warren, Pa.—Until Oct. 22, by S. R. Mason, Chairman Committee, for three buildings and one dwelling house for State Hospital.

Pierre, S. Dak.—Until 2 p. m., Nov. 4, by the Commissioner of Indian Affairs, Washington, D. C., for constructing a brick office with plumbing, steam heat and electric light, a brick warehouse with electric light, and brick addition to the workshop with plumbing and electric light, also an electric light plant. Further information may be obtained from J. C. Levengood, Supt. Indian School, Pierre.

Richmond, Va.—Until noon, Oct. 21, by Geo. B. Davis, Supt. Pub. Charities, for removing old floor in bakery at White City Home, and laying concrete floor and concrete conduit; also for painting, enameling, graining, etc., interior of White City Home.

Seattle, Wash.—Until 3 p. m, Nov. 12, by Wm. Markham, Secy., Regents of University of Washington, for erection of engineering building, a chemistry building and an auditorium building for the State University. Howard & Galloway, Architects, 604 Mission St., San Francisco, Cal.

Milwaukee, Wis.—Until 10:30 a. m., Oct 22, by Charles J. Poetsch, Chairman Bd. Pub. Wks., for constructing hose tower for fire engine house No. 11.

St. Croix Falls, Wis.—Until 2 p. m., Nov. 1, by Harry D. Baker, Chairman Committee on County Property; for the erection of one story to the present jail building at Balsam Lake, Wis., including fireproof floor and partitions, cells on both first and second story, heating, plumbing, piping and fixtures for acetylene gas lighting. Fremont D. Orff, Arch., 615 Lumber Exchange, Minneapolis, Minn.

Roads and Streets,

Bids are asked on following work, the notes being arranged alphabetically by states:

Dubuque, Ia.—Until 8:30 p. m., Oct. 17, by Edmund A. Linehan, City Recorder, for constructing 3,000 sq. yds. brick pavement on concrete foundation.

Chicago, Ill.—Until 10:15 a. m., Oct. 19, by Board Local Improvements, 216 City Hall, for two contracts for paving with creosoted wood blocks, two contracts for asphalt, two contracts for brick and two contracts for granite blocks pavement.

Lincoln, Ill.—Until 2 p. m., Oct. 18, by Chas. E. Barow, Clerk, Bd. Local Improvements, for improvement of North Kickapoo St. Work includes 9,977 sq. yds. brick pavement on 5-in. concrete foundation, 2,800 cu. yds. grading, and 6,124 lin. ft. concrete combined curb and gutter.

Quincy, Ill.—Until Oct. 19, by Board Local Improvements, for 3,891 sq. yds. brick pavement and 1,652 ft. sandstone curb.

Fort Wayne, Ind.—Until 7:30 p. m., Oct. 24, by H. W. Becker, Clerk Bd. Pub. Wks., for paving Knitters Ave., with vitrified block.

Goshen, Ind.—Until 7:30 p. m., Oct. 21, by George H. Rimpler, City Clerk, for constructing sidewalks.

Indianapolis, Ind.—Until 10 a. m., Oct. 18, by Board Public Works, for two contracts for grading and paving roadway with brick, one contract for grading and paving roadway, one contract for grading and paving sidewalks with cement, and two contracts for grading, graveling and rolling roadway.

Jasper, Ind.—Until 1 p. m., Nov. 4, by M. A. Sweeney, County Auditor, for grading,, draining and paving with stone, 4,235 ft. of road in Patoka Township.

Logansport, Ind.—Until Oct. 22, by Board Public Works, Chas. E. Ringleben, Chairman, for paving Huber St., with brick; also for constructing concrete curbs.

Michigan City, Ind.—Until 5 p. m., Oct. 21, by Board Public Works, for two cement sidewalks.

Rockville, Ind.—Until 1 p. m., Nov. 7, by H. A. Henderson, County Auditor, for constructing macadam road on line between Parke and Fountain Counties.

Salem, Ind.—Until 1:30 p. m., Nov. 4, by Sam. G. Ellis, County Auditor, for the construction of seven gravel roads in Monroe, Pierce and Jackson Townships, of total length of 20¼ miles. Estimated cost $16,307.

St. Paul, Minn.—Until 2 p. m., Oct. 21, by R. L. Gorman, Clk., Bd. Pub. Wks., for grading Fry St.

Kansas City, Mo.—Until 11 a. m., Oct. 24, by E. A. Harper, City Engineer, for constructing asphalt pavement in portions of Grand Ave., Walrond Ave. and Anderson Ave.

Buffalo, N. Y.—Until 11 a. m., Oct. 22, by F. G. Ward, Comr. Pub. Wks., for 5 contracts for paving streets.

Albany, N. Y.—Until 3 p. m., Oct. 21, by Isidore Wachsman, Clerk Board of Contract and Supply, for paving portion of Sherman St., with vitrified blocks and portion of Robin St., with granite blocks.

Brooklyn, N. Y.—Until 11 a. m., Oct. 23, by Bird S. Coler, Borough President, for five contracts for regulating and repaving with asphalt pavement.

New York, N. Y.—Until 2 p. m., Oct. 21, by Henry S. Thompson, Comr., Pub. Wks., for 2 contracts for regulating and repaving with wood block pavement, three contracts for regulating and repaving with asphalt, and seven contracts for regulating and repaving with asphalt block pavement.

Concord, N. C.—Until noon, Oct. 24, by County Commissioners for grading and macadamizing about ten miles of public road from Concord to Kannapolis, also about one mile on the Concord and Charlottle road. Plans and specifications may be seen at the office of Quint E. Smith, Civil Engineer, Concord, N. C. Official advertisement will be found elsewhere in this issue.

Cleveland, O.—Until 11 a. m., Oct. 30, by Julius C. Dorn, County Clerk, for repairing pavement on Wooster Pike in Middleburgh and Strongsville Townships.

Toledo, O.—Until noon, Oct. 18, by Reynold Voit, Secy., Bd. Pub. Service, for repaving 19th St., with either sheet asphalt or bitulithic; also for repaving an alley.

Troy, O.—Until 10 a. m., Nov. 12, by E. E. Pearson, County Auditor, for building 2,800 lin. ft. of macadam road; also for substructure on bridge and reinforced concrete culvert. Work includes: 5,000 cu. yds. earth excavation, 28,000 cu. yds. rock excavation, 2,070 cu. yds. masonry, 160 cu. yds. reinforced concrete, 3,373 sq. yds. macadam, 360 lin. ft. of piling. H. J. Walker, County Engineer.

Butler, Pa.—Until Oct. 23, by State Highway Department, Harrisburg, Pa., for constructing 1,370 ft., 18-ft. wide, brick road in Butler Borough.

Harrisburg, Pa.—Until Oct. 17, by W. H. Lynch, Commissioner of Highways, for 4 sections of resurfacing, 10,500 sq. yds.

Millevale, Pa.—Until Nov. 5, by Borough Clerk, for paving and curbing.

Philadelphia, Pa.—Until noon, Oct. 21, by George R. Stearns, Director of Public Works, for repaving streets.

Scranton, Pa.—Until Oct. 22, by S. R. Acker, Director Pub. Wks., for grading Alder St. and paving Irving Ave. and Dix Court.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Jasper, Ala.—Until 8 p. m., Oct. 21, by Mayor and Council for construction of sanitary sewers.

Dubuque, Ia.—Until 8:30 p. m., Oct. 17, by Edmund A. Linehan, City Recorder, for constructing 5,398 lin. ft. 8-in. tile pipe sewer and 26 manholes.

Chicago, Ill.—Until 10:15 a. m., Oct. 19. by Board Local Improvements, 216 City Hall, for two contracts for tile pipe sewer, one contract for brick sewer; one contract for brick and tile sewer, and one contract for system of brick and tile pipe sewers; also three contracts for drains.

Decatur, Ill.—Until 2 p. m., Oct. 17, by Board Local Improvements, for construction of 10-in. lateral sewer.

Quincy, Ill.—Until Oct. 19, by Board Local Improvements, for constructing 429 ft. of 10-in. pipe sewer.

Aurora, Ind.—Until Oct. 21, by F. D. Johnson, City Clerk, for constructing sewer in District No. 1.

Michigan City, Ind.—Until 5 p. m., Oct. 21, by Board Public Works, for constructing 10-in. vitrified tile sewer.

Burlington, La.—Until 4 p. m., Oct. 21, by J. F. Winters, City Engineer, for constructing vitrified pipe sewers in several alleys.

Cedar Rapids, Ia.—Until 10 a. m., Oct. 24, by W. C. Byers, Chairman Pub. Improvement Committee, for constructing 6 and 8-in. pipe sewers.

Tecumseh, Mich.—Until 1 p. m., Oct. 29, by W. J. Jones, Clerk Board Trustees, for furnishing all labor and material for building 1,020 ft. 15-in., 500 ft. 12-in., 11,318 ft. 10-in., 28,227 ft. 8-in., and 14,674 ft. 6-in. pipe sewer. The Riggs & Sherman Co., Engineers, Toledo, O.

Cloquet, Minn.—Until noon, Oct. 19, by Joseph Loisel, City Clerk, for construction of sanitary sewer.

Virginia, Minn.—Until 8 p. m., Oct. 22, by Albert E. Bickford, City Clerk, for constructing sewer in District No. 3 G.

St. Paul, Minn.—Until 2 p. m., Oct. 21, by R. L. Gorman, Clk. Bd. Pub. Wks., for constructing sewer along right of way of "Soo" Ry. and in Case St.

Kansas City, Mo.—Until 11 a. m., Oct. 24, by E. A. Harper, City Engineer, for constructing district sewers in three districts.

Albany, N. Y.—Until 3 p. m., Oct. 21, by Isidore Wachsman, Clk Bd. Contract and Supply, for constructing vitrified pipe sewer in Bonheim St.

Auburn, N. Y.—Until Dec. 3, by Board Public Works, for constructing sewers in 4th, 5th, 6th and 7th wards.

Enid, Okla.—Until noon, Oct. 18, by E. R. Lee, City Clerk, for constructing 3,050 ft. of 8-in. vitrified pipe sewer.

Altoona, Pa.—Until 6 p. m., Oct. 18, by G. W. Kuebler, Chairman Bd. Pub. Wks., for constructing three sewers of a total length of 2,080 ft.

Millvale, Pa.—Until Nov. 5, by Borough Clerk, for constructing a sewer.

Scranton, Pa.—Until 11 a. m., Oct. 18, by C. R. Acker, Director Pub. Wks., for construction of Division St. sewer.

Sherman, Tex.—Until Oct. 21, by Mayor C. Craycroft, for constructing sewer line to Austin College. Work includes 3,000 lin. ft. of 10-in. pipe, 1,600 lin. ft. of 8-in. pipe, 750 lin. ft of 6-in. pipe, 17 manholes and one flush tank. Charles Haydon is City Engineer.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Phoenix, Ariz.—Until 3:30 p. m., Dec. 1, (change of date) by Robt. Craig, Superintendent of water works, for the following: (1) Furnishing material and labor for completion of contemplated improvements; (2) Supplying material only; (3) Necessary work for installation of same. Official advertisement will be found elsewhere in this issue.

Chicago, Ill.—Until 10:15 a. m., Oct. 19, by Board Local Improvements, 216 City Hall, for two contracts for laying water supply pipes, and one contract for water service pipes.

Bicknell, Ind.—Town Board is reported to be asking bids for material and labor for constructing combined water and light plant.

Pipestone, Minn.—See under Bids Asked—Buildings.

Camden, N. J.—Until 8 p. m., Dec. 17, by Joseph Potter, Chairman Council Water Committee, for improving the present artesian water supply system and adding to the present supply of 17,000,000 gallons at least 5,000,000 gallons daily.

Swanton, O.—Until noon, Oct. 21, by A. B. Lathrop, Secy. Trustees Public Affairs. for material and labor for distribution system. Approximate quantities are as follows: 113 tons cast iron pipe, 4½ tons special castings, 11 valves, 11 valve boxes, 12 hydrants, laying 5,700 ft. cast iron pipe. Wm. G. Clark, Engineer, 1050 Spitzer Bldg., Toledo, O.

Chilocco, Okla.—Until 2 p. m., Nov. 7, by Commissioner of Indian Affairs, Washington, D. C., for improving water system at Chilocco School. Further information may be obtained from S. M. McCowan, Supt., Chilocco, Okla.

De Pere, Wis.—Until 4 p. m., Oct. 25, by M. J. Maes, City Clerk, for material and labor for water works extension, to include: 840 ft. 10-in., 3,200 ft. 8-in., and 500 ft. 6-in. cast-iron pipe, 7,500 lbs. special castings, 8 hydrants, 4 valves, laying 4,600 lin. ft. pipe.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

New Boston, Ill.—Ditch and Levee Work.—Until 2 p. m., Nov. 7, by Commissioners of Bay Island Drainage and Levee District for construction of five sections of levee work involving 774,900 cu. yds. Bids are also asked on two sections of ditch work involving 303,300 cu. yds. Harman Engineering Co., Peoria, Ill., are the Engineers.

Detroit, Mich.—Dredging.—Until 3 p. m., Nov. 20, by Col. E. L. B. Davis, U. S. Engrs., for rock and earth excavation at Section 3, Plan B, Detroit, Mich.

Long Prairie, Minn.—Ditch Work.—Until 1 p. m., Oct. 21, by Walter Peltier, County Auditor, for constructing Ditch No. 19.

St. Paul, Minn.—Dredging.—Until 10 a. m., Oct. 21, by E. G. Krahmer, County Auditor, for removing weeds, mud, etc., from three lakes, 13 acres in extent.

Ortonville, Minn.—Ditch.—Until 10 a. m., Oct. 21, by the County Auditor, for constructing a ditch.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Kokomo, Ind.—Electric Plant.—Until Nov. 8, by Board Public Works, for installation of electric light plant and furnishing city with electric lights. W. T. Meek, City Clerk.

New Orleans, La.—Monument.—Until 11 a. m., Nov. 14, by Col. E. H. Ruffner, U. S. Engrs., 1539 Louisiana Ave., for completion of monument to memory of American soldiers who fell in the battle of New Orleans at Chalmette.

Baltimore, Md.—Street Lighting.—Until 11 a. m., Oct. 23, by Robt. J. McCuen, Supt. Lamps and Lighting, City Hall, for furnishing, installing, equipping, maintaining and operating gasoline or naphtha street or outdoor lamps, with the use of incandescent mantle fixtures for a term of one, two, three and five years, beginning March 1, 1908.

Salmon River, N. B.—Breakwater Extension. Until Oct. 26, by Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont., for construction of breakwater extension.

Kansas City, Mo.—Tree Planting.—Until 11 a. m., Oct. 24, by E. A. Harper, City Engineer, for materials and labor for planting trees on a number of streets.

Brooklyn, N. Y.—Wood Fences.—Until 11 a. m., Oct. 23, by Bird S. Coler, Borough President, for putting up 1,312 lin. ft. of 6 ft. high board fence around vacant lots.

New York, N. Y.—Ferry House.—Until noon, Oct. 31, by J. A. Bensel, Commissioner of Docks, Pier A, Battery Pl., for furnishing labor and materials required for preparing for and building a new ferry house for the Staten Island ferry, at the Manhattan Terminal, at the foot of Whitehall St., Borough of Manhattan. Security required is $100,000.

New York, N. Y.—Train Signals.—Until 2 p. m., Oct. 24, by James W. Stevenson, Commissioner of Bridges, 13 Park Row, for the construction of train spacing signals for the elevated railway tracks of the Brooklyn bridge. Security required is $10,000.

Atlantic City, N. J.—Boardwalk.—Until 8 p. m., Oct. 28, by J. W. Hackney, City Engineer, for construction of boardwalk; to be about 2,920 ft. in length and to be constructed with a wood floor upon wood or reinforced concrete joists supported by reinforced concrete girders and columns.

Fort Schuyler, N. Y.—Wharf Work.—Until 11 a. m., Nov. 1, by Lieut. Chas. L. Fisher, Q. M., for repairing quartermaster wharf.

Harrisburg, Pa.—Stone Removal.—Until Nov. 1, by R. S. Conklin, Commissioner State Department of Forestry, for removal of stone in carload lots.

Reading, Pa.—Subway.—Until Oct. 18, (readvertisement), by Caleb Weidner, City Clerk, for constructing subway and appurtenances under P. & R. Ry. tracks at Spring St. All bids received Sept. 25 on this work were returned unopened. Elmer H. Beard, City Engineer.

Dallas, Tex.—Lock and Dam. Until noon, Nov. 18, by Capt. W. P. Wooten, U. S. Engrs., for building locks and dams No. 2 and 4 on Trinity River, Tex.

Fort D. A. Russell, Wyo.—Steel Fence.—

Until 11:30 a. m., Nov. 4, by Capt V. K. Russell, Constructing Q. M., Cheyenne, Wyo., for furnishing all material and labor required to construct a steel fence for enclosing quartermaster's corrals, at Fort D. A. Russell, Wyo.

Materials, Machines, Supplies, Tools Etc

Bids are asked on following work, the notes being arranged alphabetically by states:

Phoenix, Ariz.—Water Pipe.—See under Bids Asked Water Supply.

Washington, D. C.—Pumps, Cement, Etc.—Until 10:30 a. m., Nov. 8, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission for furnishing under Circular 397, the following: Boiler Feed Pumps, Row Boats, Whale Boats, Wire Rope, Portland Cement, Rivets, etc.

Owosso, Mich.—Boilers.—Until Oct. 23, by Board Public Works, for furnishing and installing complete two Scotch Marine boilers at water works plant. Bids are wanted on two boilers of 150 H.-P. each, or two boilers of 200 H.-P. each.

Pontiac, Mich.—Boiler.—Until noon, Oct. 21, by H. G. Mormon, Supt. Pub. Wks., for Continental boiler of 200 H.-P., with Morrison suspension furnaces; steam pressure 160 lbs.

Brooklyn, N. Y.—Portland Cement.—Until 11 a. m., Oct. 23, by Bird S. Coler, Borough President, for furnishing and delivering 500 bbls. Portland cement.

New York, N. Y.—Nozzles, Tools.—Until 10:30 a. m., Oct. 22, by Francis J. Lantry, Fire Commissioner, 157 E. 67th St., for furnishing and delivering nozzles, tools, etc., for new fire boat.

New York, N. Y.—Broken Stone, Screenings.—Until 3 p. m., Oct. 24, by the Park Board, Arsenal Bldg., 5th Ave. and 64th St., for furnishing and delivering 1,000 cu. yds. broken stone of trap rock, and 5,000 cu. yds. screenings of trap rock for parks, Borough of the Bronx.

New York, N. Y.—Electrical Equipment.—Until 2 p. m., Oct. 24, by James W. Stevenson, Commissioner of Bridges, 13 Park Row, for the electrical equipment of the University Heights bridge. Security required is $2,000.

Milwaukee, Wis.—Fire Hose.—Until 10:30 a. m., Oct. 22, by Charles J. Poetsch, Chairman Bd. Pub. Wks., for furnishing 7,000 ft., 2½-in. fire hose and 3,000 ft. 3½-in. fire hose.

CONTRACTS LET.

The following contracts have been let recently:

Ensley, Ala.—Storm Sewers.—C. M. Burkhalter & Co., at $5,500.

San Francisco, Cal.—Paving, Sewers.—Repaving with asphaltum Gilmore St., City Street Improvement Co., at $22,523; storm and drainage sewers in Drumm St., J. A. Dowling, at $15,875; storm sewer in Stuart St., Williams & Bilser, at $5,318.

Denver, Colo.—Bridge.—C. G. Sheeley, Denver, Oak St. bridge, at $5,950.

Washington, D. C.—Sewer.—W. F. Brenizer Co., Washington, at $11,600.

Washington, D. C.—Canal Dredges.—Newport News Shipbuilding & Dry Dock Co., 6 steel dregdes, at $120,000.

Fort Dade, Fla.—Tank and Trestle.—R. D. Cole Mfg. Co., Newman, Ga., at $17,854, for steel tank and trestle for Fort Dade.

Rock Falls, Ill.—Bridge.—Clinton Bridge & Iron Works, Clinton, Ill., at $3,755, for bridge over Howland Creek; will have concrete floor and rest on concrete piers.

Bloomington, Ill.—Railroad Work.—Fisher Bros., Joliet, construction of Bloomington, Pontiac & Joliet Ry.

Danville, Ill.—Bridge.—James Ganon, Stony Creek bridge, at $3,750.

Bluffton, Ind.—Road Work.—Amos G. King, gravel road in Jefferson township, at $8,197 and J. N. Neff, gravel road in Lancaster township, at $7,196.

Evansville, Ind.—Bridges.—Bennett Whitehead, 3 concrete bridges at $1,365, $1,055 and $1,045.

Harmon, Ill.—Bridge.—W. H. Shous, Freeport, concrete substructure of a bridge across Dowd Creek at $782 and the Billmire Bridge & Iron Co., Ashton, the superstructure at $1,162.

Indianapolis, Ind.—Culverts, Bridges.—Culvert over Big Run, Lawrence Township, W. C. Smith, at $1,150; bridge over Indian Creek, Lawrence Township, Garfield, Greer & Co., $1,095; bridge over Pogues Run, Center Township, Theodore Frazier, $6,600.

Fort Benjamin Harrison, Ind.—Garbage Crematory. Lewis & Kitchen, 1200 Michigan Ave., Chicago, Ill., at $1,200.

Indianapolis, Ind.—Paving.—Improvement of Marlowe Ave., Marion County Construction Co., at $2.92 for asphalt roadway, $1 for water connections, $1 for sewer connections and $5 for gas connections.

New Castle, Ind.—Bridges.—Pan American Bridge Co., New Castle, at $3,550 for 4 bridges.

Portland, Ind.—Road work.—Following were the low bidders Oct. 8 for county road work, the contracts probably having been let to them: D. R. Williamson road and J. W. Williamson road, Scott & Sons, Fort Rocovery, Ind., at $10,380; Schlecty road, Scott & Sons, Fort Recovery, Ind., at $17,468; Pensinger road, Homer Teeters, Portland, Ind., at $4,965; Strock road, Rohr & Rohr, Ansonia, O., at $9,570; Stratton road, George Weaver, Como, Ind., at $13,997; Swhier road, Lawrence Rook, Dunkirk, Ind., at $11,575; Nixon road, Lowry & Manix, Fort Recovery, at $7,499; Hawkins road, Scott & Sons, Fort Recovery, at $13,187; Gagle road, Scott & Sons, at $14,764; Glendenning road, Wheat & Sisk, Bearcreek Township, at $10,500; Crowell road, L. O. Bears & Co., Geneva, Ind., at $6,306; Rogers road, Wheat & Sisk, at $5,800; Beals road, Wheat & Sisk, at $3,800; Lee road, Wheat & Sisk, at $4,147.

Rushville, Ind.—Pike Road.—Amos W. Stevens, at $4,383, for James A. Williams pike road.

Frederick, Md.—Bridge.—The Drake & Stratton Co., Philadelphia, substructure of new bridge over Monocacy River and McClintic-Marshall Co., Pittsburg, the superstructure.

Salem, Mass.—School Building.—The Woodbury & Leighton Co., Boston, new High School Building.

Springfield, Mass.—Bridge.—The Culgin Pace contracting Co., New York, Peconsic Ave. bridge at $9,600.

Mexico City, Mex.—Water Supply.—Westinghouse Electric & Manfg. Co., Pittsburg, waterworks pump stations operated exclusively by electric power.

Stambaugh, Mich.—Water Supply.—Chicago Bridge & Iron Wroks, Washington Heights Station, Chicago, steel tower and tank for water works system.

St. Joseph, Mich.—Concrete Work.—John Allmendinger at $13,951, for retaining walls and concrete abutments to new Wayne St. viaduct.

Mankato, Minn.—Sewer.—C. M. Masters for extension of sewer on Bradley St.

St. Paul, Minn.—Sewer.—O'Neil & Preston at $5,357, for sewer in Goff Ave.

Two Harbors, Minn.—Bridge.—N. Freeberg, Concrete bridge on Cedar St., at $4,730.

Kansas City, Mo.—Railroad Work.—The Lantry Contracting Co., Kansas City, 2,000 ft. tunnel into Duluth, Minn., for Wisconsin Central R. R., and the ballasting of the Tidewater R. R. This work will require 1,200,000 yds. of ballast. Contract price is three-fourths of a million dollars.

Portsmouth, N. H.—Power Plant.—C. M. Leach, Navy Yard, Boston, Mass., power house at the naval station at $41,363.

Monett, Mo.—Sewer System.—J. J. Dunnegan, Shenandoah, Ia., at $51,988, for sewer system including laying 9 miles of pipe.

St. Joseph, Mo.—Sewer.—Hartman Bridge & Construction Co., at $3,260.

Aurora, Neb.—Sewer.—Municipal Construction Co., Kansas City, Mo., at $8,725.

Fort Hancock, N. J.—Water Supply.—Hungerford & Terry, Pennsylvania Bldg., Philadelphia, filtration plant at $6,520.

Carlsbad, N. M.—Bridge.—Bruce & Witt, reinforced concrete bridge, 214 ft. in length and 24 ft. in width.

Rochester, N. Y.—Park Improvement.—H. N. Cowles, sewers, walks and grading part of Driving Park tract at $19,932.

Mount Morris, N. Y.—Road Work.—McCarthy & Simerson, at $3,625, for Macadamizing Main St.

Marion, O.—Road Work.—Brady & O'Connel, at $3,800, for constructing White Oaks road.

Newark, O.—Sewers.—S. J. White at $1.20 per ft. for sewer in Union St.; Frank Kinney at 96 cts. per ft., for sewer in 11th St.

Reading (P. O. Cincinnati), O.—Road Work.—M. G. Roth, Reading, at $9,837 for sewering, macadamizing, etc., on Vine St.

Akron, O.—Sewer.—E. McShaffrey, storm water sewer in High, Long and Yale Sts., at $1,518.

Toledo, O.—**Bridge.**—The Toledo Massilon Bridge Co., 1,200 ft. iron bridge over the Maumee River at Damascus Landing, at $65,000.

Reading, Pa.—Grading.—James O'Rourke, at $1,694, for grading Mineral Spring road.

Wilkes-Barre, Pa.—Rosser & Hawkins, Kingston, Pa., for laying sewers in N. Washington St., Auburn St., and School House Lane.

No. Wilkes-Barre, Pa.—Sewers.—Rosser & Harkins, Kingston, laying sewers in No. Washington, Auburn St., and School House Lane, and George McAlarney, No. Wilkes-Barre, for furnishing necessary sewer pipe.

Fort Worth, Texas.—Railroad Work.—The Sunderman-Dolson Co., Houston, grading the Fort Worth, Weatherford, Mineral Wells Electric R. R.

Coatesville, Pa.—Grading, Bridge Work.—Willauer & Co., Pottstown, Pa., for grading, for change in alignment of about ½ mile of Wilmington & Northern R. R. (Reading) at Coatesville; also for masonry for double track, 4-span, 250-ft. long railroad bridge. Contract for bridge superstructure was let to L. F. Shoemaker & Co.

Galveston, Tex.—Jetty Work.—Charles Clarke & Co., Galveston, for jetty extension and repair work at this harbor for U. S. Government. The bid was $3.09 per ton for the north jetty, and $3.64 for the south jetty. The following approximate quantities are to be used for the south jetty Apron, 10,000 tons; core, 36,000 tons; slopes below fifteen feet of water, 12,000 tons, slopes above fifteen feet of water, 16,000 tons; crest, 10,000 tons. For the north jetty repairs, 20,000 tons of rip rap from one-man stone to one-half ton.

Amarillo, Tex.—Railroad Work.—Dalhof Construction Co., Little Rock, Ark., for 22 miles of reconstruction work on C., R. I. & P. Ry. cut off from Amarillo to Tucumcari, N. Mex.

Parkersburg, W. Va.—Manufacturing Plant.—J. S. Higgs, Parkersburg, new plant of the Meyercord-Carter Co., at $27,250.

Morgantown, W. Va.—Culvert, Fill.—Zevely-Casto Construction Co., at $18,123, for culvert and fill over Deep Hollow.

Richford, Vt.—Bridge Abutments.—Sweat-Comings Co., at $1,000, for concrete abutments for bridge at Main St.

La Crosse, Wis.—Sewer.—Thill & Lapitz, La Crosse, for seven blocks of sewer.

Whitehall, Wis.—Sewer.—Thill & Lapitz, La Crosse, for constructing three blocks of sewer.

PROJECTED WORK.

Railroads.

Items Arranged Alphabetically by States.

Attalla, Ala.—Alabama Northeastern Ry. Co., recently incorporated, will have main offices at this place. As projected the road is to be built from Gadsden to the Tennessee River at Tuscumbia. S. E. Gardner, Laudersville, Ala., is President and H. L. Hunter, Falkville, Ala., is Secretary.

Little Rock, Ark.—Local press reports quote W. M. Whitenton, General Superintendent of Choctaw Division, C., R. I. & P. Ry., as stating that extensive improvements are to be made to the lines in Alabama and Louisiana. These include the expenditure of about $1,000,000 in Little Rock, $300,000 at Winnfield, in yard and roundhouse construction, and a like sum at El Dorado. Extensive ballasting is also planned, and the construction of a new line through Eunice, La., to afford a connection with New Orleans, is under way. J. M. Stark, Little Rock, Ark., is Principal Assistant Engineer.

Pine Bluff, Ark.—Location surveys are stated to have been completed from this place to DeValls Bluff and Lonoke for the projected Pine Bluff North & South R. R. Right of way has been secured. Thos. A. Bell, St. Louis, Mo., was in charge of the engineering work.

Auburn, Cal.—Southern Pacific Ry. has opened right-of-way office here and has established engineering force in this city, with the object, it is thought, of making a cut off from Loomis to Bowman, thus doing away with the Penryn grade.

Oakland, Cal.—Plans are reported to have been completed by Southern Pacific Ry. engineers for the extension of the local and suburban service to Hayward in connection with the electrization of its steam roads. A double track road will be constructed. A. H. Babock, San Francisco, Cal., is Electrical Engineer, S. P. Ry.

Suisun, Cal.—Vallejo & Northern Ry. has now secured a complete right-of-way through American Canyon.

Evansville, Ind.—Carter Construction Co., Walinseidler Bldg., which has contract for building the Chicago, Indianapolis & Evansville R. R., is stated to have let contract for 10,000 tons of rails, to be used on the road. The road as projected is to start at Indiana Harbor and will pass through Indianapolis and on through the coal fields in Central and Southern Indiana.

Bartlesville, Ind. T.—Surveys have been made, right-of-way secured and work will be started soon, it is said, on the construction of the St. Louis, Bartlesville & Pacific R. R. The line is to run from Webb City, Mo., through the Quapaw Nation to Bartlesville, through the Osage reservation to Pond Creek, Okla., where connection is to be made with the Rock Island system. Connection probably will also be made with the Kansas City, Mexico & Orient R. R. Frank M. Overlass, Bartlesville, Ind. T., is President.

Kansas City, Kan.—The Gulf Short Line Ry. Co., to build from Kansas City, Kan., to Post Layaca, Tex., capitalized at $36,000,000, estimated length, 1,500 miles, including branches, has been chartered. The incorporators are: J. P. Byrne and Louis E. Potts of Oklahoma City; Fred A. Jeran, La Junta, Col.; Charles F. Bridge and Joseph Ragsdale, Topeka, Kan. Offices of the company will be at Kansas City, Kan., and Oklahoma City.

Hopkinsville, Ky.— Advices from this place quote E. C. Weston, General Manager of the Cairo & Tennessee River R. R., as stating that the contract for 108 miles of the line—from Wickliffe to Hopkinsville—has been let and that construction work will be started by the end of October. As projected the road is to run from Wickliffe to Bristol, Tenn., a distance of 425 miles.

Grand Forks, N. Dak.—C. H. McFarlane, St. Paul, Minn., has completed surveys for line of North Dakota Ry. from Edinburg to the Portland cement mines, a distance of 21 miles. It is planned to have much of the grading done this fall.

Brookings, S. Dak.—Brookings & Sioux Falls Ry. Co. is having surveys made for its projected line.

Harrisburg, Pa.—Governor Stuart has approved the charter application of the Mingo & Monongahela R. R. Co. to build a 12-mile line in Washington County, to connect the Baltimore & Ohio and Pennsylvania lines.

Philadelphia, Pa.—Philadelphia Subway Terminal Ry. Co. will probably at once ask City Council for franchise. The company proposes to construct a subway for railroad purposes in Broad St., from the north side of Filbert St. to a point near North Philadelphia Station, where it will connect with the Pennsylvania's Germantown and Chestnut Hill branch. Those interested are: George W. Goddard, Torresdale, President; Montgomery Harris, 326 West Willow Grove Ave., Germantown; Charles Willing, Montgomery Ave., Chestnut Hill, directors.

Pulaski, Tenn.—Citizens of this place and Lawrenceburg, Tenn., are considering advisability of building a railroad from either Cornersville or Elkton westward to Bolivar, Tenn., there to connect with either the Southern or the Illinois Central. J. H. Ragsdale, Pulaski, and R. H. Harvey, Lawrenceburg, are the Promotion Committee.

Flodada, Tex.—Preliminary surveys are to be started at once for a route for the Llana Estacodo R. R., which is to be built from this place to some point on the Santa Fe., northwest from here, and probably on to some connection with the Rock Island system. W. W. Massie is President.

Sherman, Tex.—Advices from this city state that surveys are now under way for the establishment of permanent lines for the extension of the Missouri, Oklahoma & Gulf Ry. into Texas. H. S. Moore, Muskogee, Ind. T., is Chief Engineer.

San Antonio, Tex.—A new road to the Rio Grande is to be chartered by Col. Uriah Lott. The road will be known as the San Antonio-Mexico Ry. The charter will call for the construction of 560 miles of road, with the main line extending from San Antonio to a point near Brazos Santiago. The survey is to begin at once.

Electric Railways.

Items Arranged Alphabetically by States.

Geneva, Ala.—Electric railway is to be built between this place and Dothan, it is announced. Richard Tillis, Montgomery, Ala.

Eureka Springs, Ark.—Citizens Electric Co., owners of local street railways and electric plant, has been sold to Fort Smith parties, who will expend $600,000 for improvements. The electric line will be extended for 9 miles and an amusement park built. George Sengel, Fort Smith, Ark., is President.

Chico, Cal.—D. H. Brammer, Paradise, Cal., is promoting project to electrize the Butte County R. R. from Chico to Paradise.

San Diego, Cal.—Los Angeles & San Diego Beach Ry. is to be extended 2 miles to San Diego marine biological station.

Jacksonville, Fla.—Jacksonville Electric Co. has been granted franchise to extend its tracks in Lincoln Ave.

Macon, Ga.—Macon Railway & Light Co. proposes to extend its line on Columbus Road.

Tampa, Fla.—Tampa & Sulphur Springs Co. is to increase capital stock from $100,000 to $300,000. Company proposes to build a line to West Tampa, constructing a steel bridge at Ross Ave.

Burlington, Ia.—Advices from this place state it is probable that Rock Island Southern Interurban Ry. will extend its line between Monmouth and Galesburg, Ill., to this place next spring.

Davenport, Ia.—Nearly all of the right-of-way has been secured for a new interurban line from Davenport to Dubuque by way of Maquoketa. It is probable that construction work will be started in the spring. O. McCaffrey, Maquoketa, Ia., is interested.

Marshalltown, Ia.—Business men of this place have agreed to subscribe $25,000 for the Welbourne interurban project, promoted by Hamilton Browne.

Boone, Ia.—Boone, Webster City & Northern Interurban Ry. Co. is to be incorporated shortly and proposes to have a line in operation within another year between Boone and Webster City, 31 miles. J. S. Crooks, Boone, Ia., is Secretary of the company, which is to be incorporated with $600,000 capital stock.

Chicago, Ill.—Western Illinois Traction Co., capitalized at $100,000, has been incorporated and proposes to construct a line from Lyons to Aurora. Headquarters are in Chicago and M. M. Miller, Edmund J. Schmidt and Wm. Klein are directors.

Joliet, Ill.—Messrs. H. A., F. E. and Lee D. Fisher, of Joliet, Ill., have secured control of the Bloomington, Pontiac & Joliet, already in operation between Pontiac and Dwight, and will, it is said, complete the road to Bloomington and Joliet.

Evansville, Ind.—Evansville, Petersburg & Vincennes R. R. Co., recently incorporated, to build an interurban line through Petersburg to Evansville, has already secured 11 miles of the right-of-way. The whole route has been surveyed and it is said that active construction work will be started in the spring. F. W. Cook and T. M. Honeywell, Evansville, are interested.

Decatur, Ind.—Fort Wayne & Springfield Ry. Co., A. W. Fishbaugh, Chief Engineer, may extend its trolley line south to Berne next year.

Muskogee, Ind. T.—Falls Construction Co., capitalized at $2,500,000, has been incorporated by S. M. Rutherfords, E. A. Hill, J. M. Brogan and Ira L. Reeves, all of Muskogee, for building an electric line for the Muskogee Navigation Co. from Muskogee to Fort Smith.

Owensville, Ky.— Kaufman-Shaw Construction Co., Dayton, O., proposes to build an electric railroad from Salt Lick to Carlisle via Owingsville and Sharpsburg, a distance of 30 miles.

Moorhead, Minn.—Work is to be started shortly, it is said, on the construction of the line of the Northwestern Interurban Electric Ry. Co. At a meeting in this city recently Thos. T. Bubb was elected President and Chief Engineer.

Columbus, O.—Ohio & Southern Traction Co. has increased its capital stock from $75,000 to $90,000.

Humboldt, Tenn.—Ordinance is before City Council asking for franchise in this city for an electric, which it is proposed to build from this place to Dyersburg. Col. T. H. Dungall, Humboldt, is promoting the project.

Houston, Tex.—Houston Electric Co. is said to be planning to extend its street car system to Harrisburg, 5 miles distant.

Fond du Lac, Wis.—Western Engineering Co., Milwaukee, Wis., is stated to be making surveys for a route for the Milwaukee & Fox River Ry.

Sewers.

Items Arranged Alphabetically by States.

Birmingham, Ala.—Jefferson County Sanitary Commission, R. B. Smyer, Secy., will build additional septic tanks for Village Creek system.

Alamosa, Colo.—Town Board has passed ordinance to put in $40,000 sewer system. Bids are to be asked at once, it is said.

Covington, Ga.—Plans and specifications have been made for sewer and water systems for this place. A $55,000 bond issue for the work was voted Oct. 9. J. B. McCrary, Atlanta, Ga., is Engineer.

Springfield, Ill.—Board Local Improvements is considering construction of sewers in North Grand Ave., Osborne Ave., Miller St. and Brown St.

Pauls Valley, Ind. T.—A $45,000 bond issue for constructing sewers and water works has been voted.

Wellington, Kan.—Surveys have been made for sewer system.

Howell, Mich.—Issuance of $25,000 of bonds for building sewer system will be again voted upon.

St. Paul, Minn.—Board of Public Works rejected bids for constructing Cass St. sewer. Estimated cost is $10,140 and lowest bid exceeded this by $2,260.

Richmond, Mo.—Special election is to be held Nov. 5 to vote on establishing sewer system.

Lancaster, N. Y.—Site has been purchased on which to erect a $20,000 sewage disposal plant.

Enid, Okla.—Bond issue for $285,000 for storm sewer construction has been voted. Also bond issue for $10,000 for septic tank.

Springfield, O.—Board Public Service will shortly ask for bids for the construction of the high level intercepting sewer. Estimated cost is $92,000.

Chambersburg, Pa.—Citizens will vote at November election on issuance of $90,000 of bonds for building sewer system.

Kane, Pa.—State Health Department has granted permit to this Borough suggesting joint sewage disposal works with private company operating in suburbs.

East McKeesport, Pa.—Joint study of sewage problems for chain of boroughs in lower Turtle Creek Valley has been suggested by State Health Department.

Reading, Pa.—Sewers to cost $90,000 are to be constructed in District No. 12.

Scranton, Pa.— Construction of sewage plant in 10th ward is under consideration.

Carlisle, Pa.—Borough Council has accepted plans of T. Chilkley Halton, Consulting Engineer, Wilmington, Del., for sewer system and disposal plant for this place. The system will cost about $148,676. D. Edward Brindle is Burgess.

Harrisburg, Pa.—C. F. Hessenberger, Harrisburg, at $11,000, was low bidder for first section of sewers at State Sanitarium at Mont Alto.

Ka[illegible]e, Pa.—Construction of new sewers is proposed.

Chambersburg, Pa.—A $90,000 bond issue for constructing sewers is to be voted on.

Scalp Level, Pa.—Town is to construct a $2,500 sewer.

Huron, S. Dak.—Plans for new sewer system are reported to be completed.

Denton, Tex.—Council has granted Col. M. P. Kelley franchise for sewer system.

Beeville, Tex.—Construction of 2-in. sewer in Washington St. is proposed.

Logan, Utah.—Installation of sewer system for this place is under consideration.

Water Supply.

Items Arranged Alphabetically by States.

Grand Junction, Colo.— Special election will be held Nov. 2 to vote on issue of $75,000 additional bonds for mountain water supply system.

Anamosa, Ia.—Election will be held Oct. 28 to vote on municipal water works. A $30,000 bonds issue will be voted on.

Anna, Ill.—Anna Water Works Co., capi-

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talized at $14,000, has been incorporated. George Safrod is interested.

East Chicago, Ind.—East Chicago & Indiana Harbor Water Co. has been incorporated by H. R. Phillips and others. Capital stock is $5,000.

Wabash, Ind.—City Council at next session will probably grant franchise to Wabash Water Co., owned by First National Bank of New York City.

Kenner, La.—Kenner Ice & Cold Storage Co., capitalized at $25,000, may construct water works here. Edw. Stoulig is President.

Clinton, Mich.—Town has voted to raise $53,000 for fire protection system.

Enid, Okla.—City has voted to issue $15,000 of bonds for water main extensions.

Stillwater, Okla.—D. B. Merry, Sanitary Engineer, Winfield, Kan., has made preliminary estimates for extension of city water works.

Scranton, Pa.—Ordinance is again before City Council to grant City Water Co. franchise to furnish water to residents of this city.

Bristol, Tenn.—Council has voted to issue $15,000 additional water bonds.

Palestine, Tex.—Plant, equipment and privileges of Palestine Water Works Co. has been sold to Thomas Cronin.

Brooklyn, Wis.—Citizens voted against issuing bonds for installing water works.

Glovergap, W. Va.—Baltimore & Ohio R. R. is to construct reservoir at this place, at a cost of $17,000. A. M. Kinsman, Baltimore, Md., is Engineer of Construction, B. & O. R. R.

De Forest, Wis.—This place has voted to install water works

De Pere, Wis.—A $60,000 bond issue for water works extension is proposed.

Sheboygan, Wis.—Ordinance has been before council providing for bond issue to allow of taking over local plant on Jan. 1.

Clinton, Ont.—A $52,000 bond issue for establishing water works has been voted.

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PROPOSALS FOR WATER PIPE.

Office of the Superintendent of the Water
Department of the City of Phoenix, Ariz.,
September 25, 1907.

Separate bids will be received by the Superintendent of the Water Works of the City of Phoenix, Arizona, at the office of the said Superintendent, up until 3:30 p. m., of December 1, 1907, for the following:

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2. Supplying material only.

3. Necessary work for the installation of the same.

Specifications can be obtained, upon application, from the Superintendent, at City Hall, Phoenix, Arizona.

A certified check for five per cent of the amount of the bid, made payable to Frank Thomas, Recorder for the City of Phoenix, is to accompany each proposal, to be held as a guarantee that a contract with bond approved by him will be entered into by the party whose bid is accepted, in accordance with the terms of the said bid.

The Superintendent reserves the right to reject any or all bids, in whole or in part.

ROBT. CRAIG,
16-3t Superintendent.

PUBLIC ROADS.

Concord, N. C.

The Board of Commissioners for the County of Cabarrus will receive sealed bids up to noon, October 24th, 1907, at Concord, N. C., for grading and macadamizing about ten miles of public road from Concord to Kannapolis, also about one mile on Concord and Charlotte road. Plans and specifications may be seen at the office of Quint E. Smith, Civil Engineer, Concord, N. C.

16-2t JOHN A. CLINE,
Chairman County Commissioners.

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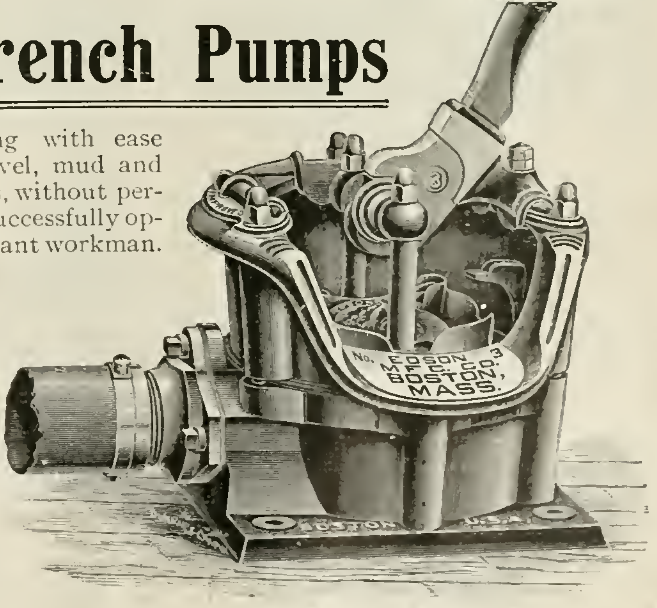
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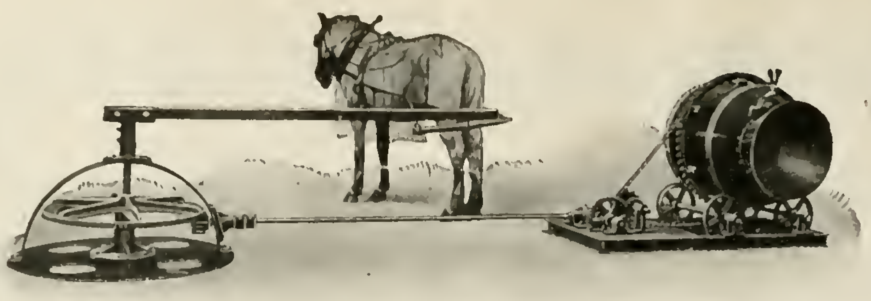

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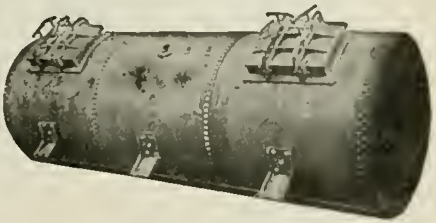

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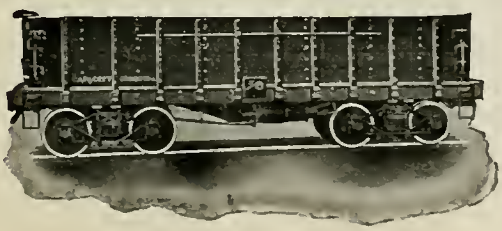

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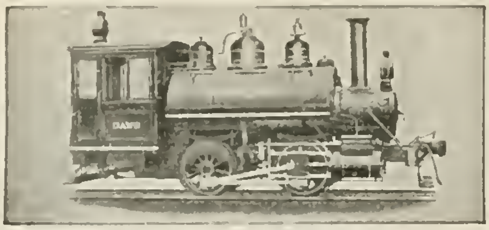

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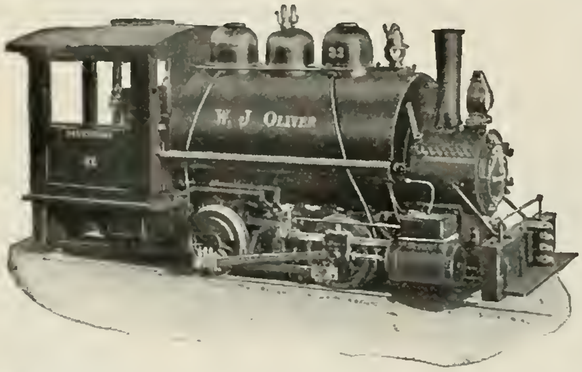

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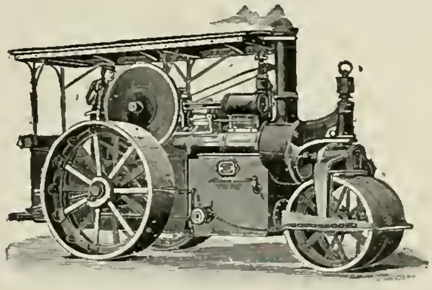

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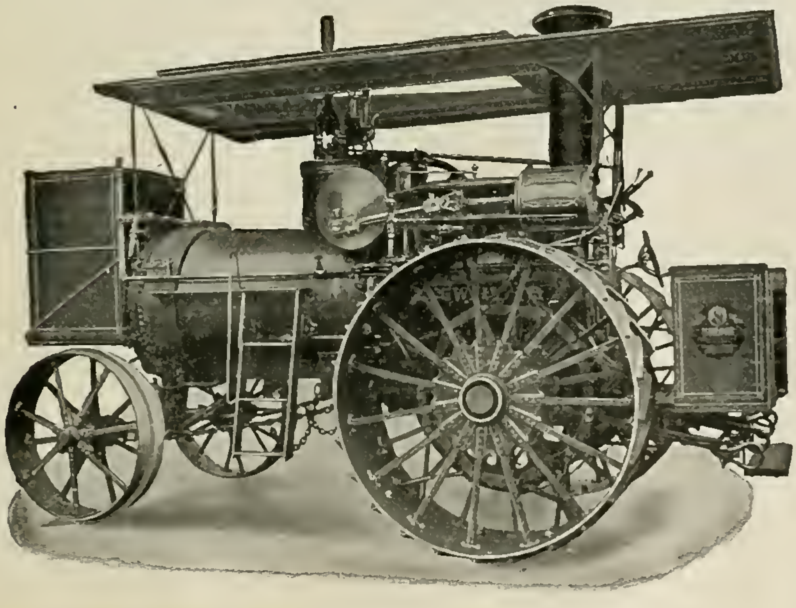

As to amount of work, the engine will handle heavier loads and make longer hauls than any number of horses that could be reasonably used on one machine. If necessary, the engine can work night and day, another advantage over horses and men. We build these engines from sixteen to thirty one horse power; and they are guaranteed to produce at least their rated horse power.

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A Cement Products Exhibition.

An event which promises to be of great interest to engineers and contractors for concrete work is the exhibition being planned by the Cement Products Exhibition Co. to be held in Chicago, Ill., on Dec. 17 to 21 of this year. As planned the purpose of the exhibition will be to illustrate and explain methods of doing concrete work as well as to show materials and machinery for cement and concrete workers. To this end most of the machinery will be shown in operation. A special feature is also to be made of form work, methods of framing, erecting and removing being shown by actual full size forms. The same effort is to be made to have the leading manufacturers of reinforcing bars and frames present the work of forming and placing their various styles of reinforcement. We believe that engineers and contractors should take occasion to visit this exhibition, as it promises to be of an unusually practical nature.

Efflorescence on Concrete.

Efflorescence is the term applied to the whitish or yellowish accumulations which often appear on concrete surfaces. "Whitewash" is another name given to these blotches. Efflorescence is due to certain salts leaching out of the concrete and accumulating into thin layers where the water evaporates on the surface. These salts are most probably sulphates of calcium and magnesium, both of which are contained in many cements and both of which are slightly soluble in water. Efflorescence is very erratic in its appearance. Some concretes never exhibit it; in some it may not appear for several years and in others it shows soon after construction and may appear in great quantities. The most effective way to prevent efflorescence would naturally be to use cements entirely free from sulphates, chlorides or whatever other soluble salts are the cause of the phenomenon, but the likelihood of engineers resorting to the trouble of such selection except in rare instances is not great, even if they know what cements to select, so that other means must be sought.

The most common place for efflorescence to appear in walls is at the horizontal junction of two days' work or where a coping is placed after the main body of the wall has been completed. The reason of this seems to be that the salt solutions seep down through the concrete until they strike the nearly impervious film of cement that forms on the top surface of the old concrete before the new is added and then they follow along this impervious film to the face of the wall. It has been suggested that this cause might be remedied by ending the day's work by a layer whose top has a slight slope down toward the rear of the wall or perhaps by placing all the concrete in similarly sloping layers. Mr. C. H. Cartlidge is authority for the statement that this leaching at joints can be largely done away with by the simple process of washing the top surface of concrete which has been allowed to set over night by scrubbing it with wire brushes in conjunction with thorough flushing with a hose.

But efflorescence frequently appears on the faces of walls built without construction joints and in which a wet concrete is puddled in and not tamped in layers, and here other means are obviously essential. Waterproofing the surface of the wall should be effective so long as the waterproofing lasts; indeed, one of the claims made for some of these waterproofing compounds is that efflorescence is prevented. Failing in any or all of these methods of preventing efflorescence the engineer must resort to remedial measures. The saline coating must be scraped or chipped or, better, washed away with acids.

Efflorescence was removed from a concrete bridge at Washington, D. C., by using hydrochloric (muriatic) acid and common scrubbing brushes; 30 gallons of acid and 36 scrubbing brushes were used to clean 250 sq. yds. of concrete. The acid was diluted with 4 or 5 parts water to 1 of acid; and water constantly played with a hose on the concrete while being cleaned to prevent penetration of the acid. One house-front cleaner and 5 laborers were employed and the total cost was $150, or 60 cts. per square yard. This high cost was due to the difficulty of cleaning the balustrades. It is thought that the cost of cleaning the spandrels and wing walls did not exceed 20 cts. per square yard. The cleaning was perfectly satisfactory. An experiment was made with wire brushes without acid, but the cost was $2.40 per square yard. The flour removed by the wire brushes was found by analysis to be silicate of lime. Acetic acid was tried in place of muriatic, but required more scrubbing.

According to a recent report of the Superintendent of Streets of Chicago, Ill., that city has 4,100 miles of streets and alleys, of which 1,545 miles are paved. A total of 539 miles of streets are paved with cedar blocks, and the report states that it will be useless to attempt to repair this kind of pavement. The other principal pavements and percent of repairs necessary are as follows:

	Miles of streets.	% Needing repairs.
Macadam	529	50
Asphalt	321	1½
Brick	92	1
Granite	51	1⅓

Both branches of the Illinois Legislature have passed a resolution providing for the submission to the people of the proposed amendment to the constitution authorizing the state to issue $20,000,000 of bonds with which to prosecute the work through the water-power zone from Lockport to Utica.

In one day, Aug. 19, 1907, rain is said to have fell to a depth of 11.95 ins. at Orissa, India. The average annual rainfall at that place is 46 ins.

The new Scherzer type bascule bridge at Dearborn [illegible], Chicago, Ill., was formally turned over to the city officials on Oct. 19. The bridge cost about $250,000 and is said to be the finest bridge of its type in the city. The bridge superstructure was fabricated and erected by George W. Jackson, Inc.; the substructure was constructed by the Great Lakes Dredge & Dock Co.

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Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Method and Cost of Building a Reinforced Concrete Car Barn.

The cost of erecting a reinforced concrete carbarn at Easton, Pa., done by Mr. M. P. McGrath, contractor, is of interest on account of the method employed for handling the greater part of the materials for the concrete direct from the freight cars to the mixer.

General Description.—The carbarn was 194 ft. long and 50 ft. wide. The part of the barn for the cars was 110 ft. long, while behind it was an engine-room 40 ft long, and to the rear of this was the boiler room 44 ft. long. To one side of the barn was a small office 20x13 ft. The walls of the building, which was only one story, were 12 ins. thick, being built without pilasters. The partition walls were 10 ins. thick. Numerous doors and windows were in these walls. The roof was 4 ins. thick and had a pitch of ½-in. per ft.

There were four railway tracks in the carbarn, each running the full length with a pit under them. Fig. 1 illustrates these pits and their construction. The girders under the rails were 12x12 ins., reinforced by three 1¾-in. round rods. The girders are supported by 12x12-in. pillars spaced at equal distances. The tracks are held to gauge by tie rods, which run from the rail of one track to the adjoining rail of another track through a concrete floor that also rests on the same girders as the rails do. These floors are 6 ins. thick and are reinforced with ½-in. rods on 8-in. centers.

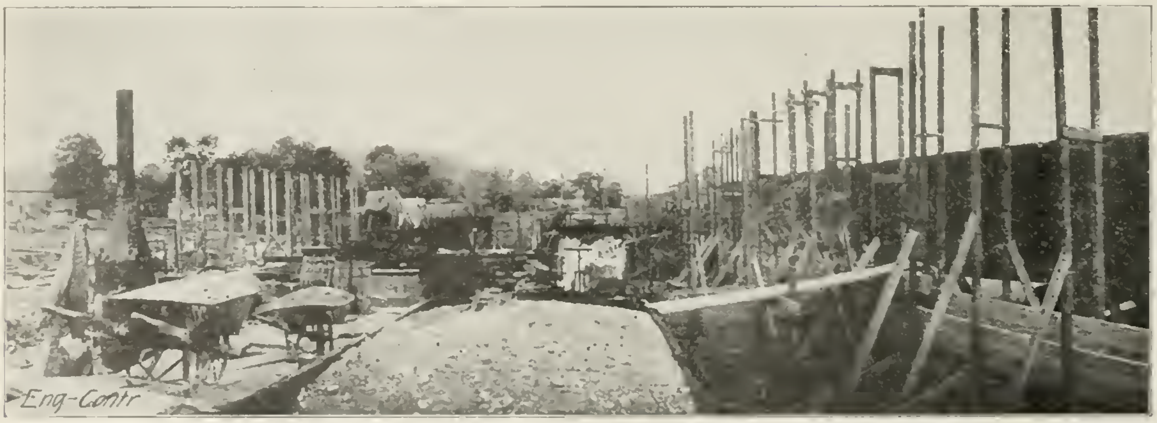


Fig. 2—View Showing Method of Handling Materials Direct From Cars to Mixers.

Quantities of Work.—The total yardage in the building was 874, divided as follows:

	Cu. yds.
Walls and foundations	614
Pillars and girders in track pits	44
Reinforced floors in carbarn	55
Roof	160
Total	874

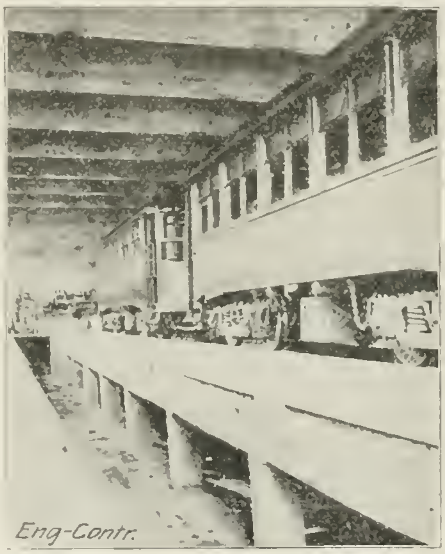


Fig. 1—View Showing Pits Under Car Track.

The floors in the engine and boiler rooms were not laid by the contractor and are not included in the yardage just given nor in the cost of the work about to be given.

The floors, roofs and girders were made of a 1:2½:5 mixture, while the walls and foundations were proportioned 1:3:6. The total amount of steel used was about 26½ tons, being 0.45% of the volume of the concrete, or 61 lbs. of steel per cu. yd.

The wages paid were as follows:

Foremen	$2.50
Blacksmith	2.00
Engineer	1.75
Laborers	1.50
Two-horse team and driver	3.67
One-horse team and driver	2.92
Carpenter	2.25

All the forces but the carpenters worked 10 hours; the carpenters worked only 9.

Forms.—The carpenters framed and erected the forms, but did not tear them down, this being done by the laborers under the direction of the carpenter foreman. Two-inch boards were used for forming, and the uprights were 3x4 scantlings. The props used to hold the roof forms, were of round timber procured on the job, being 18 ft. long with 6-in. tops. There were 91 of these used and they cost 50 cts. apiece. This meant the saving of at least 5 M. F. B. M. of lumber, an acutal saving in money of about $90. These props are not included in the lumber listed for the job, but the cost of them, with the labor of placing, will be included in the costs given. No record was kept of the number of times the lumber was used in the forms, but, in as much as 54,643 F. B. M. was bought and about twice this amount would be needed if the material was used only once, it will be safe to say that all lumber was used twice. Including the props there were about 60,000 ft. B M. Hence there were about 70 ft. B. M per cu. yd. of concrete.

The cost of the lumber was $1,520.86. while the labor cost on the forms was $1,660.60. This gives a cost per cubic yard of:

	Per cu. yd.
Lumber	$1.74
Labor on forms	1.90
Total	$3.64

If lumber enough had been bought to use the forms but once, the cost per cu. yd. would have been $5.38.

The cost of the forms per F. B. M. was:

Lumber (used twice, ½ of $27)	$13.50
Labor (paving and erecting each time)	14.07
Total	$27.57

If the material had only been used once this cost would have been $27 plus $14.07, or $41.07 per M.

The cost of forms based on the area of concrete covered with lumber, using a unit of a sq. ft., was:

	Per sq. ft.
Lumber	$0.038
Labor	0.041
Total	$0.079

Method of Doing Work.—When work was started on the power house end of the building a track was run from the main line of the railroad through the proposed lines of the building to the end or rear wall of the boiler room, upon what was eventually the fourth track of the carbarn. On this track were handled all the equipment and supplies. The boilers were unloaded from this track and all the materials for the concrete.

A Ransome concrete mixer was set up as near the track as possible, allowing a platform to be built between the track and the mixer. This method was pursued throughout the work as shown in Fig. 2. The boiler room walls were completed first, then the machine was moved back, and the track taken up to the engine room. While the walls of the engine room were being built, the roof was put in place on the boiler room. When this was finished, the mixer was moved into the carbarn, and as the walls of this room were being built, the roof of the engine room was completed. Then the track and mixer were moved outside of the building and the roof of the carbarn was made.

The materials for the concrete were generally handled direct from a car to the mixers by wheelbarrows, although a reserved stock pile was kept nearby the mixer. The method of raising the concrete to the roof is illustrated in Fig. 3. A horse, by means of a pole with an arm arrangement, making a three-quarter swing, hoisted the loaded wheelbarrows, a hook being attached to the wheel and a ring over each handle. When this work was going on, only the engineer and one man to dump the machine, beside the crew that fed the mixer, were retained on the ground, the rest of the men being on the roof. Runways were used to carry the concrete from the mixer to the side walls.

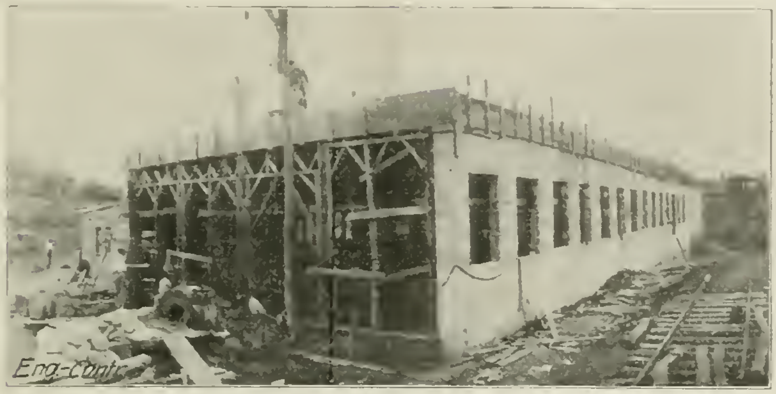


Fig. 3—View Showing Method of Hoisting Concrete for Roof Construction.

Cost of Concrete.—In the foundations, cinders were used to make the concrete, in which were placed stones varying in size from 2 to 10 ins. For the walls and roof, crushed stone was used. The following materials were used:

935 bbls. cement, $1.24	$1,159.40
665½ tons sand, 72c,	479.82
517.1 tons stone, 98c	506.76
258.8 tons cinders, 77c	199.27
52,752 lbs. steel, $0.019	1,002.29
Total	$3,347.54

This gives a cost per cu. yd. for materials as follows:

Cement, 1.1 bbls. at $1.21	$1.33
Sand, ¾ ton at $0.75	.55
Aggregate	.88
Steel, 61 lbs. at 1.9 cts	1.15
Lumber, 70 ft. B. M. at $27.00	1.74
Total	$5.65

The cost of labor per cubic yard was:

Forms	$1.900
Mixing	.210
Placing	.310
Finishing	.143
Handling cement	.017
Handling aggregate	.222
Handling Sand	.104
Handling steel	.270
Coal at $4.25 per ton	.010
Foreman	.133
Teams and laying pipe line	.087
Total	$3.406

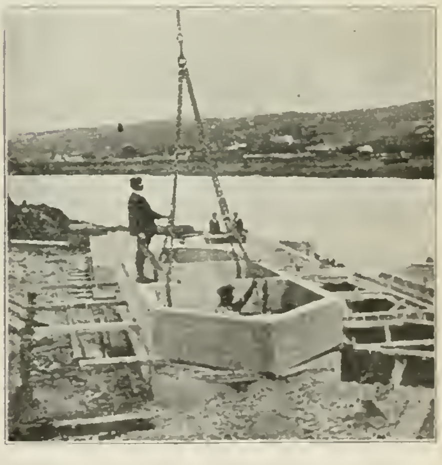
The cost per ton for handling steel, making stirrups, welding and placing was $8.90, or 0.45 ct. per lb.

The total cost per cu. yd. for materials and labor was $9.06. This cost is quite reasonable, but it will be noticed that some of the details are a little high. We are indebted to Mr. J. F. Mooney for the information in this article.

For cost of forms and erecting concrete structures, the reader is referred to previous articles in Engineering-Contracting appearing Oct. 9, 1907, p. 209; Oct. 2, 1907, p. 191; Nov. 28, 1906, p. 160.

Method of Constructing Concrete Caissons for an English Railway Bridge.

In constructing a railway bridge in England the contractors made use of reinforced concrete caissons in the following manner: Each caisson consisted of several superimposed sections the bottom-most one of which was provided with a cutting edge. These sections were molded on shore in suitable forms and after hardening four weeks were lifted and lowered into place by a crane. The accompanying engraving shows the shape of the molded parts. Each successive section was guided into position by a series of vertical rods reaching from the bottom section to above the surface of the water. The weight of each section was about 8 tons, and the concrete used was a 1-4 gravel mixture; ¾-in. round bars were used for reinforcement. The joint between successive sections was formed by molding a groove in the top edge and a corresponding tongue in the bottom edge. A roll of cement mortar inclosed in linen was placed in the groove and as the next section came to seat the tongue squeezed into the soft mortar and made a perfectly watertight joint. No staging or piling was used and the contractors state that the cost of the concrete caissons worked out at about half the amount that metal caissons would have cost. The description and the accompanying illustrations have been extracted from "Concrete and Constructional Engineering," of London, England.



Section of Reinforced Concrete Caisson.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Charts for Recording Drill Holes and Daily Report Card Showing Explosives Used.

In our issue of Oct. 2, 1907, we gave a sample punch card, showing a method of keeping a daily record of holes drilled. In this article we shall give sample charts and tables to be used in connection with these drilling record cards. The charts show the location of the drill holes and the key letter that identifies the man who drilled them, as well as the depth of the hole in feet.

Two kinds of charts are shown, each adapted for a different class of work. Fig. 1 shows a chart for use on railroads, canals and other engineering work that is laid out with a center line as a base for measurements. The ruling is the same as that for ordinary cross-section paper, used by engineers, each square representing a measurement of 2 ft. each way. Any one wishing to adopt this form can have it printed or can buy cross-section paper and make his own forms.

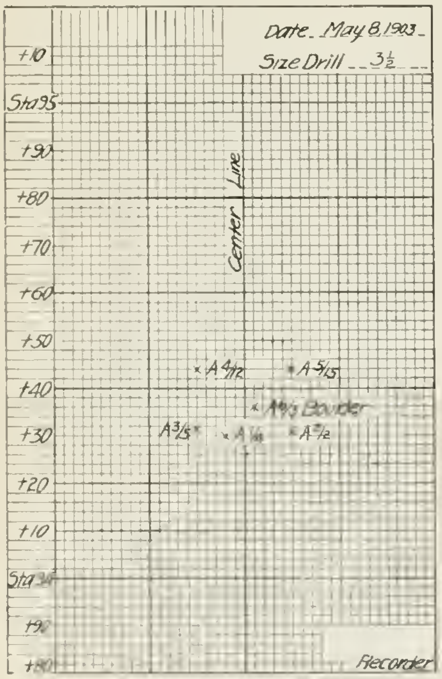
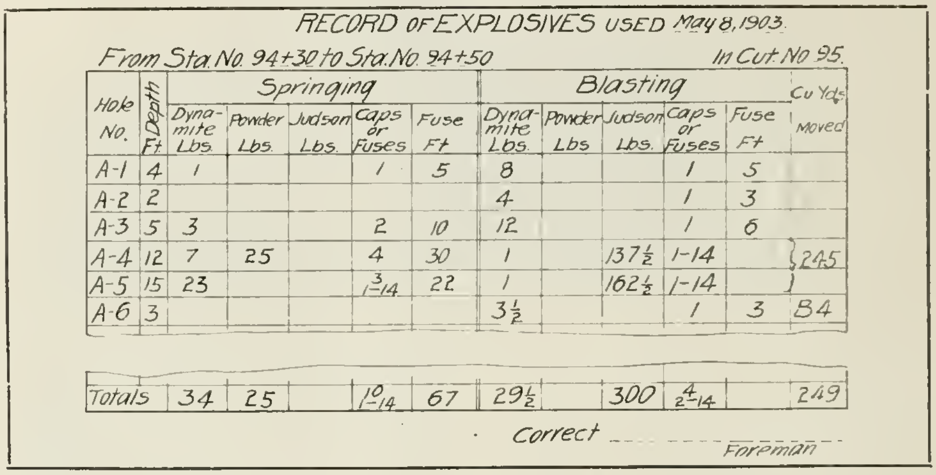


Fig. 1—Chart for Recording Drill Holes on Work That Can Be Laid Out From Center Line.

A word of explanation will show how this chart is used in connection with the form for recording explosives shown in Fig. 2. The work is being done on a new grade of a railroad in a cut that runs from Sta. 92 to Sta. 98, 600 ft. long. A stripping of 3 or 4 ft. of earth has been taken from the top of the cut by scrapers, leaving exposed a ledge of rock 12 to 15 ft. deep to sub-grade, shown in cross section taken at Sta. 95 + 50 in Fig. 3.

The two short vertical lines in Fig. 3 running through the ground surface show the position of slope stakes set by the engineer. On these stakes are marked the cutting and the station number. Some engineers also mark on the stake the distance out from the center. If this is not done the contractor should have some one do so. With this distance known it will always be possible to locate the center line, by measuring out from several slope stakes. For this purpose, as well as for other uses, every foreman should be provided with a metallic tape line. One of the editors of this paper has also provided his foreman with a half dozen steel pins like those used by land surveyors. These pins can be made by any blacksmith, and should be about 10 ins. long. Through the ring at the top a piece of red flannel should be tied so they can be easily seen and thus save them from being lost. The pins are not only useful in marking places on the ground, but a foreman, by their aid can make any measurement he desires, without assistance. He can stick a pin through the ring on his tape and make measurements without taking a man from his work to help him.



RECORD OF EXPLOSIVES USED May 8, 1903.

From Sta. No. 94+30 to Sta. No. 94+50 In Cut No 95.

Hole No.	Depth Ft.	Springing					Blasting					Cu Yds Moved
		Dynamite Lbs.	Powder Lbs.	Judson Lbs.	Caps or Fuses	Fuse Ft	Dynamite Lbs.	Powder Lbs	Judson Lbs.	Caps or Fuses	Fuse Ft	
A-1	4	1			1	5	8			1	5	
A-2	2						4			1	3	
A-3	5	3			2	10	12			1	6	
A-4	12	7	25		4	30	1		137½	1-14		245
A-5	15	23			$\frac{3}{1-14}$	22	1		162½	1-14		
A-6	3						3½			1	3	84
Totals		34	25		$\frac{10}{1-14}$	67	29½		300	$\frac{4}{2-14}$		249

Correct ________ Foreman

Fig. 2—Form for Recording Amount of Explosives Used.

In this way he can make his measurements on the ground to locate drill holes, and put them on the chart as shown in Fig. 1. In this case a driller, whose key letter is A, has been assigned to work in the cut in question. He starts by drilling a 4 ft. hole 4 ft to the left of the center line at Sta. 94+30. Then he drills a 2 ft. hole 10 ft. on the right at +31, following this with a 5 ft. hole 10 ft. on the left at the same station. These holes are drilled to "breast up" the cut at Sta. 94+32, and while these holes are being loaded and shot, and the muckers are cleaning up the blasted material, two holes are being drilled for a large blast: Hole No. 4 at 10 ft. on the left, 12 ft. deep; and hole No. 5, 10 ft. on the right, 15 ft. deep, at Sta. 94+44. After this blast is made a boulder is thrown in the way of the workers and the drill is set up to put a 3-ft. hole in it for blocking. This is hole No. 6, and notation is made on the chart to show that it was drilled in a boulder. This record can be made up by the foreman or timekeeper, from the pegs left in the holes by the driller, these pegs having burnt on them the driller's letter and the number of the hole.

The blank filled out in Fig. 2 shows how these holes were shot, and gives a record of the explosives used. Hole No. 1 was sprung once with (2) sticks (1 lb.) of dynamite, and then shot with 4 lbs. Hole No. 2 was not sprung but shot with 2 lbs. of dynamite. Hole No. 3 was first sprung with 1 lb. of dynamite, and again sprung with 2 lbs., being shot with 12 lbs. All of these holes were exploded with cap and fuse as the record shows.

Hole A-4 was sprung 4 times, first spring being with 1 lb. of dynamite, second with 2 lbs., and the third spring with 4 lbs. The fourth spring was made with one keg (25 lbs.) of black powder. Powder was used to develop a seam that was opened up at the bottom of hole by the other springs.

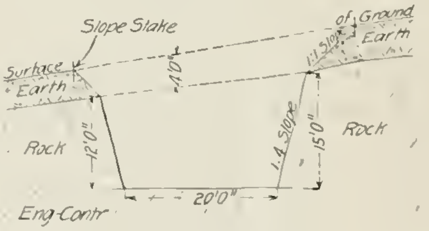


Fig. 3—Cross Section of a Railroad Cut.

The springing of No. 5 was done with dynamite, four springs being made with respectively 1, 2, 6 and 14 lbs. The last spring was shot with an electrical exploder or fuse. The small amount of fuse used in springing is caused by the fact, that for the first springs only a piece of fuse 3 or 4 ft. long was used tied to a stick of dynamite, and after being lit it was dropped into the hole. This can be done when the hole is not ragged. These two holes were shot with Judson powder, the blasts being put off simultaneously with a battery. It will be noticed that the fuses used are recorded both as to number used and as to length.

Hole No. 6 in the boulder was shot with dynamite with a cap and fuse. The column for the yardage moved can be filled in by the superintendent, or some one able to calculate the approximate quantity of rock loosened. No yardage is recorded with the first three blasts, as these blasts are chargeable against the yardage moved by the last heavy blast made in the cut.

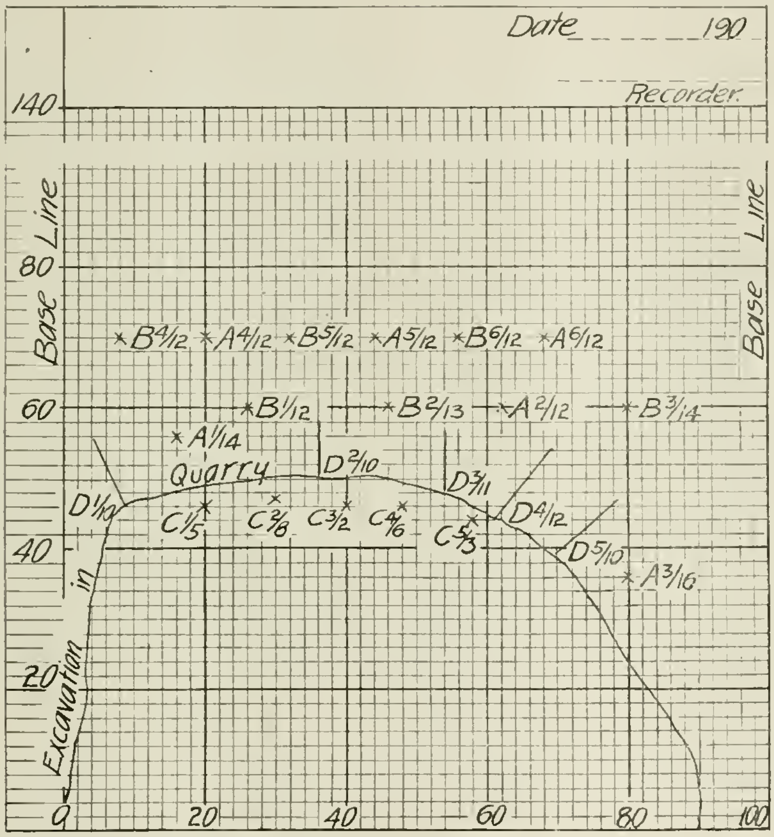


Fig. 4—Chart for Recording Drill Holes in Work in Quarries.

A separate sheet which need not have the springing columns on, can be used for blasting boulders, and in a column for remarks can be noted the method used in breaking them up, such as "block-holing," "mud-capping" and other methods.

The blasts here recorded are not given as economical ones, but rather as examples of actual blasts, in which there is nearly always used more explosives than necessary to loosen the rock. Contractors prefer to shoot rock in this way, as it is extremely expensive to loosen and break up rock after an unsuccessful blast.

The records shown on the chart and explosive sheet, should be copied upon permanent records in the contractor's office. The office chart, for showing location of the holes drilled should be on a long sheet of cross section paper, showing on the same scale as the small chart, the entire line, except the embankments. The totals from the explosive sheet should be recorded in a book made up for that purpose, which should also have columns for the drilling records, the work done by the muckers, and the transporting of the excavated material.

Fig. 4 shows a chart to be used in a quarry. A base line can be run on each side of the excavation to be made in the quarry, and from these base lines any point in the quarry can be located, for recording on the chart. These records can be transferred to an office chart that can be on a larger scale, if desired.

From the chart shown here, it will be seen that four drills are working in the quarry. Drills A and B on top of the ledge of rock, and C and D down on the breast. C is a small drill putting down shallow holes, while D is a large drill snaking in holes on the breast as indicated by the long lines drawn for the face inward.

A sheet similar to the one illustrated in Fig. 2 can be used in a quarry to record the explosives used. An accurate estimate of the yardage may be difficult to obtain at times; but it is usually possible to approximate the yardage very closely by calculating the cross-section along each line of drill holes and the distance between the lines of holes.

In some tough rocks it is frequently necessary to drill a foot or two below grade, in order to be sure to break all the rock to grade. In such cases, due allowance should be made when estimating the yardage of "pay rock" broken. In other cases, the rock breaks one or more feet beyond the outer line of drill holes, and allowance for this should be made also. But, in any given kind of rock, the foreman or timekeeper will soon learn how much to allow for these factors, and can then estimate the yardage of "pay rock" accurately from the chart of drill holes. In this manner it is possible to make a very close report of the yardage of rock broken every day, without the necessity of cross-sectioning with an engineer's level. *The rock-drill does the cross-sectioning.*

Drilling Twelve Inch Holes with a Five Inch Bit.

Mr. R. R. Sanderson, in the August issue of the "Drill Hole," gives a very interesting description of drilling a large diameter hole with a string of small tools. We abstract the following:

"Not long ago while doing some drill work for a railroad company up along the lakes, I was called upon to put down some 9-in. holes for steel anchor posts. The outfit I was using was a No. 4 Cyclone Drill, with a 12 ft. 3 in. stem and a 5-in. bit, which we were using simply to test the bed rock along the lake where the company was going to erect a dock. As these bits contained but about 40 lbs. of steel and we desired to use them again for 5-in. work, I did not want to stave them out to 9 ins., so decided to try to put down a 9-in. hole with a 5-in. bit. The holes were to be 23 ft. deep—15 ft. in dirt and 8 ft. in bed rock of massive bedded shale which was pretty hard. I started by digging a 12-in. hole a foot and a half deep with a spade. Owing to the play which the tools had above, it was easy to speed the sides of the hole down nearly straight, but as the anchor posts had to fit pretty snug in the shale, I tapered the hole from the top so that when I reached the shale the hole was reduced to about 10 ins. I now had a hole 15 ft. deep, 12 ins. at top and 10 ins. at bottom. I started the hole in the shale at 10 ins. and found that by swinging the top of the tools in the space given me by the 12-in. opening. I was able to carry the hole on down at a diameter between 9 and 10 ins. I found that there were but two points to look after. The first was to keep perfectly square corners on the bits and the other was to keep moving the top of the tools so that the bit cut full size of the hole, otherwise the hole would taper down and be no larger than the bit.

"I put down 14 holes in this manner and the only one I had trouble with was the last one, and this was due to my own carelessness in allowing the corners of my bit to round down on me.

"In drilling these holes there was another problem came up, the solution of which was new to me.

"The ground I was drilling in was right along the lake and the first 10 ft. was all made land. The top 6 ft. was crushed rock, cinders and clay and was so mixed that it stood up nicely, but the next 4 ft. was lake sand, which with the water that was in it would run like quicksand. When I struck this the first thing I did was to ask the company for casing, but the largest thing they had was the 5-in. pipe we had been using, and no other kind nearer than 70 miles away; besides I knew that if I used casing I would be compelled to use a 9-in. bit. I knew that the bed rock was not over 15 ft. deep, so that I could not have over 9 ft. of sand to contend with. As is natural to a fellow when he is up against it, all kinds of ideas came to me. I thought of using tile, of sinking a wooden curb, of using sheet iron pipe, and many other methods, but they all had the disadvantage of requiring me to use a 9-in. bit if I adopted them. Finally I thought of pasting up the hole so that the sand could not run. Now, I was on the right track. I got some good stiff clay, chopped it up pretty fine, dumped some of it in the hole and poured in just enough water to make a nice thick batter. I now put in the tools, and by keeping the batter at the right thickness, I had no trouble in reaching bedrock. The only thing I had to guard against was to keep from getting too much water in the hole at one time, as an excess of water washed the clay from the sides of the hole and let the sand run."

Device for Assisting Traction Engines.

Contractors are finding additional uses for traction engines every year. One thing that limits their use is the occurrence of short sections of ground, that are not soft enough actually to mire the engine, yet soft enough to make efficient work impossible. In order to overcome this difficulty the J. I. Case Threshing Machine Co. of Racine, Wis., are equipping their traction engines with a simple device

A winch head or winding spool is attached to the axle of the fly wheel of the engine. A snatch block is fastened to a dead man, or anchorage, on the other side of the soft ground, and by running a rope attached to the front end of the engine through the snatch block and back to the winding spool, the engine is assisted over the soft stretch of ground.

A single block and a ¾ or 1 in. rope will answer all purposes.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Pile Foundations in New Orleans and Durability of Foundation Timber.

In a discussion on foundations, at the last annual meeting of the American Society of Civil Engineers, Mr. F. C. Jonah had the following to say regarding piles as a foundation:

Foundations for all heavy structures in New Orleans are now made of piling. This is the best foundation for that locality because, in the absence of bed-rock or hardpan, piles give sufficient frictional resistance to sustain all necessary loads.

The soil of New Orleans is nearly always pure alluvium many hundreds of feet deep. There is, in various parts of the city, an underlying stratum of shells and beach sand, usually 40 ft. below the surface and from 6 to 8 ft. thick. Piles can be driven through this, but it is not considered necessary to do so, and they are stopped in this stratum. This material was encountered in driving the foundation piles for the new passenger station now being built at Canal and Basin streets, and in the foundations for the Hagan Avenue Bridge, 1 mile away, while, just below the city limits, where the new Frisco Docks are being constructed, and where more than 36,000 piles have been driven, alluvium was the only material reached. The same condition obtains on the work of the new Sugar Refinery, also just below the city limits, where more than 6,000 piles have been driven. On the dock work, which is under the writer's charge, 75-ft. piles have been driven in trenches excavated 15 ft. below the surface, so that for 90 ft., at least, there is nothing but pure silt. Careful records and experiments show that in this material a 60-ft. pile will sustain a load of 65 tons without settlement, although 16 tons per pile is the average load calculated. While these piles may be driven very quickly—as much as 4 in. per blow—it is often found that, if they stand partly driven over night, on resuming work next morning several blows are necessary to start them.

The writer has also noticed, in driving piles for trestles in New Orleans and vicinity, that while a pile might go as much as 1 ft. at the last blow, yet by the time the deck and track were on, the trestle would stand up under ordinary traffic.

The piles used are pine sticks, cut in Louisiana and Mississippi; they are very straight and smooth, will average about 60 ft. in length, 6 in. in diameter at the small end and 13 in. in diameter at the butt, and are now furnished and driven for from 30 to 35 cents per linear foot.

The occurrence of the sand and shell stratum in patches can be accounted for on the assumption that it formed part of the old coast line or probably formed small islands which were gradually connected with the mainland and covered by the upbuilding of the Mississippi Delta.

The great holding power of piles in this silt is due to the free lateral movement of the soil causing the pile to be firmly gripped as soon as driven.

In driving piles in this material some care must be exercised in their spacing, as it is possible to drive them too close to one another, in which case the frictional resistance would be measured by the circumference of the cluster rather than by the circumference of the piles separately—3½ ft. is a fair average spacing.

This foundation is undoubtedly the best for New Orleans as the piles go below the level of basements, sewers and canals; and modern buildings are being erected on such foundations without any settlement. The foundations will also be permanent, as wood, in soil of this character, when carried below the line of atmospheric and moisture changes, lasts indefinitely. This has been abundantly proven in New Orleans where, in boring for wells, logs in good preservation have been encountered hundreds of feet below the surface. Recently, in excavating for the basement of the new passenger station at Canal and Basin streets, perfectly sound cypress trees were uncovered 12 ft. below the level of Canal street.

Excavations frequently expose old foundations on cypress footings in as good condition as when put in a century ago. These footings are usually from 4 to 6 ft. below the surface.

The drainage works of the city, now in course of construction, will probably lower the water level to 8 ft. below the surface, so that in the future timber foundations may not last as well as they have in the past, unless carried below that level, which of course, is the case with pile foundations for new structures which are provided with basements.

The Prussian state railway administration has signed a contract with the German steel syndicate for the delivery of rails and steel ties covering the requirements of the railway department for three years.

Methods and Costs; Some Old; Some New.

Laying Submerged Main. — Eight-inch standard cast-iron hub and spigot water pipe, with lead joints, was used to replace a worn out wrought iron gas main under a river. Every third joint was made a flexible one to facilitate the laying and to allow the main to adjust itself to the bed of the stream. The river at the crossing was 525 ft. wide and had an average depth of 24 ft., although the depth at the middle was about 34 ft. The bottom at the middle was rock covered with 18 in. of soft silt; toward the banks the bottom was gravel overlaid with silt. A hydraulic jet handled by a diver was used in excavating a trench through the silt, water being supplied to the jet under a pressure of about 140 lbs. by a pump in a scow anchored over the work. An ordinary fire hose nozzle, with a ½ in. opening was used with good results. Three lengths of 12 ft. pipe were jointed together on the pump scow, and a flexible joint was made at the same time on each end of the 3-length section. The scow was anchored over the position the section was to occupy and the three lengths were lowered by a stiff legged derrick, the section being supported at two points, so as to keep it horizontal in laying. When a section was lowered into place on the bottom of the river the flexible joint next to the pipe already laid was made by a diver. In the middle of the river it was necessary to anchor the pipe to the rock to insure safety from displacement. Accordingly the diver bored holes in the rock on both sides of the pipe with a pneumatic hand drill. Expansion bolts were placed in these holes and strips of iron passing over the pipe attached to the bolts. The trench opened by the hydraulic jet was soon closed up by the river silt.

Marsh Road.—The following methods were used in building a road across the salt meadows between the solid land at Pleasantville, N. J., and Atlantic City. Soundings showed that the mud varied in depth from 6 to 28 ft., the surface of most of which was a floating sod, varying from 2 to 4 ft. in thickness, below which was a semi-liquid mud resting upon hard pan. The latter, in a few places, was only 4 ft. thick, and below this was another stratum of soft mud. The road constructors depended upon this first layer of hardpan to support the structure. The bridge approaches were piled, the piles being put down with a water jet and hammer. At a depth of 28 ft. the first resistance was met; at 35 ft. this disappeared and the pile with weight of hammer sank indefinitely, so the piles were stopped at 30 ft. This pit extended for only a short distance, and a solid bed of sand, gravel or clay was usually struck at a depth of from 10 to 20 ft. below high tide. After the road line was located sod banks, 5½ ft. high, 12 ft. wide at the base, and 2 ft. wide at the top were built, the sod being placed with the grass side out. The sod was taken from between the banks. The inside edges of the sod banks were 60 ft. apart. The enclosed space was then filled in with sand dredged from riparian land under the adjoining bay and pumped through pipes for a distance of one-half mile or more. As the sand settled it pushed the mud sideways until it reached an equilibrium or the sand rested on hardpan. When the bed of sand was 6 ft. above the level of the meadow the weight was sufficient to displace all the mud and a good foundation was secured. Over salt ponds where there was no sod for banks, hard pine bulkheads were substituted at a cost of $4.50 per lineal foot. After the sand fill had thoroughly settled the roadway was given the proper curvature and surfaced with a coating of gravel. Substantial railing protects both sides of the road. The above work was done under supervision of J. J. Albertson, Engineer of Atlantic County, N. J.

Filing Office Records.—The following methods of filing and indexing office records are used in the Engineering Department of the city of Springfield, O.: All correspondence received bearing on a certain subject and of sufficient importance to keep is given a file number. This number appears on all correspondence relating to this subject. For example, letters containing important information regarding the building of a bridge on Fountain Ave. across Buck Creek are received from several bridge companies. The letters are given a file number, say No. 250, and recorded in the index under the letter "B," as "Bridge across Buck Creek at Fountain Ave., No. 250"; under the letter "F" as "Fountain Ave. bridge across Buck Creek, No. 250"; and under the first letter of the name of the bridge company, as "Fountain Ave. bridge across Buck Creek, No. 250." In answering correspondence a carbon copy is made of the letter. The typewritten letter is copied into the ordinary letter book and indexed in the book. The carbon copy is attached to the correspondence received and placed in its proper file. These files consist of plain manila paper ¼ in. wide and 1½ in. larger than a sheet of typewritten paper. The letters are placed on this sheet of paper and the extra length folded down across the top; on this folded top margin is recorded the file number. These files are placed in an ordinary file box, with the numbered edges toward the front end. Each large file box bears on its front a paster showing the serial number of the files contained therein. Reports, survey notes, deed descriptions, small survey tracings, etc., are folded and placed in flat, heavy paper files such as attorneys use in filing away court cases. Each file is numbered and properly and copiously indexed in a "Report, etc." Index of the same style as is used in indexing correspondence. In order that they may be kept clean and not become scattered, they are then placed in a large paste board file box of the same length and breadth but of sufficient height to hold from 10 to 25 or more smaller files. Each file box bears on its front a paster showing the numbers contained therein. All maps and plans shoud be kept clean, flat if possible, and free from creases and folds. The city has two flat top cases 56 ins. wide by 40 ins. deep by 42 ins. high, each containing five drawers, size 52 by 36 ins. by 3 ins. deep, and four drawers, size 22 ins. by 36 ins. by 3 ins. deep. In the lower right hand corner of every map, plan or plat in a space of 1½ by 3 ins., appears the following: Engineering Department; Springfield, Ohio: No. ..; Scale ..; Date ......; Surveyed by ......; Drawn by ......; for uniformity's sake, a rubber stamp or stencil may be used. All plats that can be kept flat and are not too large are filed away in the drawers. Each drawer is lettered and bears a paster showing the letter and numbers of plats contained therein; thus "A" 1 to 80; "B" 80 to 190, etc. Plats and profiles that cannot be filed in drawers, are rolled up and placed in a wall case, containing a number of compartments 7 ins. high, 6 ins. wide and 30 ins. deep. One end of the wall case contains compartments 12 ins. high, 10 ins. wide and 60 ins. deep, for very large plats. All plats bear a small paper tag 1 in. by 1½ ins., such as are used by merchants, having the number of the plat on one side and an abbreviation of the title on the other side. From 20 to 40 plats are placed in each pigeon hole. Each case is lettered and the compartments bear a paster as an aid for finding the desired number quickly and insuring its return to the proper compartment. The index is of the same style as described heretofore and plats are indexed thus, Plan of Reservoir—Drawer A. No. 37 or Profile of Main Street Sewer, Case D, No. 125. Field books are numbered consecutively. All survey notes and levels are recorded in a level book, as it is of a convenient size. The pages of these books are all numbered. Field books and pages and the bench mark elevation are recorded on each plat. The index is of the same style as described heretofore.

According to the annual report of the State Tax Commissioner of Texas the railways in that state on Jan. 1, 1907, possessed property, tangible and intangible to the amount of $420,000,000.

Cost Keeping on Sewer Work.

BY KEITH O. GUTHRIE*, ASSOC. M. AM. SOC. C. E.

The report cards shown below were designed to gather detailed cost records from scattered sections without increasing the ordinary clerical force. They have been used on a large sewer contract in charge of the writer, producing records in handy shape for daily and bi-monthly comparison, easily compiled into compact totals for future reference. The entire extra expense of the working system has only amounted to the first cost of printing.

It is common practice, and properly so, on cost reports to print the desired items of distribution and adhere to them throughout. Otherwise it is the tendency to increase the number of special items ad infinitum, making comparison difficult. However, on these reports, three extra lines were left to cover special conditions, such as pumping, laying sub-drain, etc., occurring only on one or two sections. It is often difficult to secure, on daily reports, an accurate statement of the amount of work done. This is easily obtained on sewer work by referring everything to the stations or "grade-boards." This method obviates everything, and the daily distances check up when totaled for any period of time. Indeterminate items, like teams, can be arbitrarily coupled with some suitable item, such as Excavation or Arch.

To get an accurate distribution of a payroll it is necessary, of course, to have the amount of the pay-roll. That the foreman might find this readily, and, in part as a reminder, the different classes of labor are tabulated on the left.

Toward the end of the day the foreman first jots down the stations of completed work, then from his time-card, having simply the check numbers, rates and hours worked, he draws off his day's pay-roll, finding it to be, as in the case taken, $83.10. He now distributes first the minor items, which is readily done from memory. For example, the Bracer and his three helpers worked on "Sheeting"; the two men on "Backfilling" car; the three who "Pulled Sheeting" for five hours; the two bending and setting "Steel Bars"; the two carpenters and one laborer on "Forms," and so on, until there is left only Excavation and Concreting. As a rule the men who have been in the ditch can be readily counted up, and Concrete Invert, or Arch, gets the balance of the pay-roll. The last item, of course, gets some of the odds and ends, but that is better and far safer as a basis for future estimating, than heaping them into a "Miscellaneous" item by themselves.

These reports are daily collected by the general timekeeper and checked up by him as to correctness of pay-roll amount. They can then be used for comparison between different sections, or between different days on the same section, without further tabulation. At the end of a half month it takes not more than an hour to foot up the totals of a section and post on the same card, which is then ready to file in a card cabinet as a permanent record.

The "Material" Report shown was gotten up to catch the elusive cement empties and to follow the quantities used on different parts of the sewer. By checking with the storekeeper's records, the loss of bags or waste of materials can be learned soon enough to take advantage of it.

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*Engineer P. J. Murray & Co., & Henry Dumary, Brooklyn, N. Y.

FOREMAN'S DAILY PAY ROLL REPORT.

Location....*14th Avenue*....*No. 2*....*96" Sewer*............... Date.. ..*August 7, 1907*.....

Itemized Pay Roll.			Work Done.			Pay Roll Distributed.
Foreman....*1* days at...	*4 00*	*4 00*	*General Night Watchman and Water Boy*.....			*2 25*
Engineer....*1* " " ...	*3 50*	*3 50*	Excavation completed to station,	*18.40*	Cost..	*19 25*
Labor .....*1* " "	*3 00*	*3 00*	Sheeting " " "	*18.30*	.....	*8 25*
" .....*27.4* " "	*1 75*	*47 95*	Foundation plank " " "	*18.00*	.....	*2 63*
" ... *11.8* " " ...	*1 50*	*17 70*	Backfilling " " "	*16.90*	.....	*3 00*
" .... " " ..	......	......	Sheeting Pulled " " "	*17.10*	.....	*2 62*
Carts...... *1* " "	*3 00*	*3 00*	Concrete Invert " " "	.....	.....	......
Teams.....*2-10* " "	*6 00*	*1 20*	Brick Invert " " "	.....	.....	......
Hoister. ..*1* " "	*2 00*	*2 00*	Concrete Sides } " " "	*17.48*	.....	*29 62*
Water boy.. *1* " "	*75*	*75*	Concrete Roof } " " "	....	.....	......
			Steel Bars set " "	*17.48*	....	*3 50*
			Forms set to station............	*17.48*	....	*7 25*
			Forms, pipe laid to station..........		....	......
Total day's pay roll..........		*83 10*	Manholes built to-day..........		....	......
			Other items......*Pump*..............		....	*58*
			Teams working...*Cement*........	*17.48*	....	*1 20*
			Carts working....*Gravel*.	*17.48*	....	*3 00*
			Total day's pay roll		......	*$ 83 10*

Signed——*L.— W.*——.....Foreman.

Cost Keeping on Sewer Work—Blank for Daily Report of Foreman.

(The blank was 8½ in. long by 5⅜ ins. wide. In the reproduction words in italics and figures are shown to illustrate use of blank in a specific case.)

The Valuation of Water Works Properties.*

BY CHAS. B. BURDICK.†

In essentials the procedure is the same whether the valuation has as its object the change of ownership of the property from private to public or whether it is made for the purpose of determining a fair return upon the investment. There are some differences, however, in the details of procedure. It is not within the province of this paper to treat of valuations made to assist in transactions between individuals. Such valuations, and they are more numerous than all other, are largely a matter of investments and revenues, past, present and future.

Let us first consider the case of a company plant valued for prospective purchase by the municipality under its contract right. In the absence of statements to the contrary, in the contract or franchise, the elements of value are as follows:

First, the physical value of the property as it exists at the time of the valuation, less its depreciation; second, the "going value" hereinafter defined; and, third, the "franchise value," if any.

THE PHYSICAL PROPERTY.

The valuation of the physical plant must be based upon an accurate knowledge of the property. It is usually based upon an inventory, preferably jointly prepared by the parties at issue. The inventory is sometimes prepared by the appraisers themselves; it is sometimes prepared and furnished by the owner of the property and subsequently verified by the city. The inventory should set forth exactly and concisely of what the property consists. It should give the date of installation of each part of the plant, the circumstances bearing upon its depreciation, and its condition at the time viewed. All should be set forth in such detail and circumstantiality that the statement may be readily verified. The whole should be summarized in such manner as to permit the assignment of values with the least labor. It is important that the inventory be prepared by one who has had sufficient experience in water works construction as to appreciate those things which enter into or affect the matter of value, and it is further important and of great advantage in the subsequent consideration of the inventory by appraisal that the inventory be prepared by one who is familiar with the method and practices of appraisal boards in viewing these properties.

In addition the inventory should set forth the history of the plant both physical and financial. It should contain a statement of the growth in pumpage and consumption, taps and consumers, the income, the operating expenses and the maintenance. All this information is of service in fixing the "going value" and the value of the franchise. The statement should cover as long a period of years as possible, running back to the inception of the plant if the data is available. All statements should be in sufficient detail, that they may be readily verified, and that the appraisers may form judgment as to their reasonableness.

Having in hand a proper inventory, a

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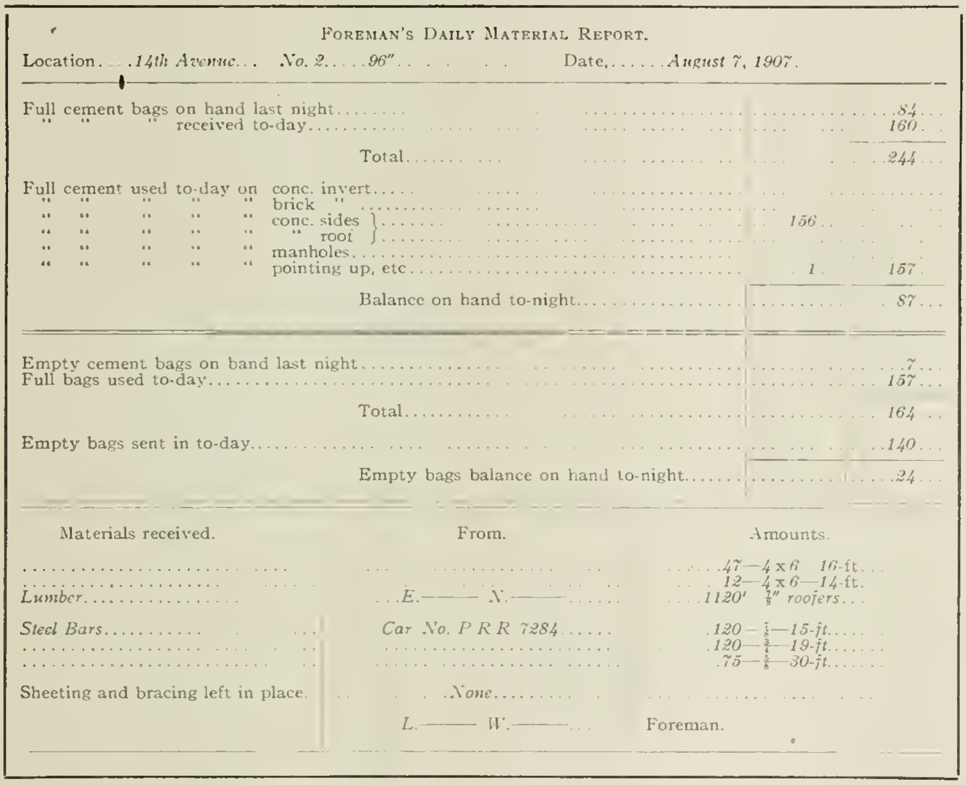
*Abstract of paper read before Wisconsin League of Municipalities.

†Hydraulic and Sanitary Engineer, Chicago, Ill.

board of experienced appraisers will examine the property and verify the inventory statement with a minimum of labor, and their valuable time will be free for the consideration of the values to be attached to the properties covered by the inventory.

The value of the physical property is usually based upon the cost of duplicating it under prices prevailing at the time of appraisal. In the average plant, at prevailing prices, from one-third to one-half of the physical value consists in cast iron water mains and their appurtenances, valves and hydrants.

During the writer's experience, covering the past 12 years, the price of this commodity in the central west has varied between $15 and $40 per net ton. This period, however, includes a time of commercial depression and the period of great activity during the past four years. In the years 1870 to 1876, when but few small works were constructed, the price of pipe averaged about $50 per ton. From 1876 to 1884, covering a period of active water works construction, the price ranged between $35 and $45. From 1883 to 1890, a further period of water works activity, $25 to $35. From 1890 to 1897, $15 to $30. Since 1897 the price has gradually risen (with some ups and downs) to its present price of about $35 per ton.



FOREMAN'S DAILY MATERIAL REPORT.

Location. *14th Avenue* *No. 2* *96"* Date, *August 7, 1907*.

Full cement bags on hand last night		*84*
" " " received to-day		*160*
Total		*244*
Full cement used to-day on conc. invert		
" " " " " brick "		
" " " " " conc. sides }	*156*	
" " " " " " roof }		
" " " " " manholes		
" " " " " pointing up, etc	*1*	*157*
Balance on hand to-night		*87*

Empty cement bags on band last night	*7*
Full bags used to-day	*157*
Total	*164*
Empty bags sent in to-day	*140*
Empty bags balance on hand to-night	*24*

Materials received.	From.	Amounts.
		47—4 x 6 16-ft.
		12—4 x 6—14-ft.
Lumber	*E.—— N.——*	*1120' ⅞" roofers*
Steel Bars	*Car No. P R R 7284*	*120—⅞—15-ft.*
		120—¾—19-ft.
		75—⅝—30-ft.
Sheeting and bracing left in place	*None*	

L.—— W.—— Foreman.

Cost Keeping on Sewer Work—Form for Foreman's Daily Material Report.

(The blank was 8 in. high by 5 in. wide. In the reproduction the words in italics and figures are shown to illustrate use of blank in a specific case.)

All the original pipe systems have been added to largely, and it is probable that the prices which have been applied in water works appraisals during the past five years do not differ materially from the average price or average cost per ton in company water works plants built since 1875.

The cost of machinery to a limited extent follows the price of cast iron and other metals. It is, however, largely influenced by labor, and although the cost of labor has materially increased of late years, special machinery and a better understanding of requirements has resulted in a materially less cost for machinery than prevailed 30 years ago, and there is a much greater margin between the prices prevailing in the fifties, sixties and seventies and those of to-day. As of other commodities, the price of machinery was at its low ebb in the late nineties, since when it has increased in price from 25 to 50 per cent.

Labor has lately shown a decidedly upward tendency. The price of lumber and building materials generally has gradually increased for ten years past. Upon the contrary, heavy masonry can be constructed to-day cheaper than ever before, due to the greatly decreased cost of cement and the better understanding of cement and concrete construction.

From what has been said as to the fluctuation of prices, it may rightly be judged that there have been periods when appraisals upon the cost of duplication theory may have been considered to work hardship upon one party or another. It would seem a hardship to compel an investor to part with a property upon the basis of a $15 pipe, if the average price actually paid was $30. This might have happened in appraising property in 1897 or 1898 that had been constructed prior to 1890. The converse of this would tend to work a hardship upon the purchaser. It is true, however, that the purchaser, individual or municipality, has the power to fix the time of purchase within certain limits, and this is not true of the seller having a contract to sell at the option of the prospective purchaser. It will be observed that there is room for a wide experience and a broad judgment in order that values may be assigned equitable to all concerned.

Depreciation.—Depreciation, as the word is applied in water works valuation, means the falling in value or reduction of worth of the property, as compared to a new property similar to it in essential respects. It may take place through a variety of causes. Use, wear, lack of care, the action of element or of soil, all tend toward a lessening of usefulness.

A further source of depreciation, particularly in machinery and processes, lies in advancement due to new inventions. A machine otherwise good must be considered as depreciated if means have been invented for accomplishing the same work in a cheaper or better way. A particular device may also be depreciated by an obvious mistake in its selection; by the application of a machine, good in itself, not adapted to the work that it performs.

In general our water works systems are less depreciated than the public is sometimes brought to believe. As before stated, a considerable part of water works value lies in cast iron pipe. In ordinary soils this is one of the most durable of materials. In fact, experience in the use of pipe extending over a period of more than 100 years has not been sufficiently lengthy to demonstrate its ultimate life. There is uncoated cast iron pipe that has been in service for that length of time, and within the past 50 years a pipe coating has been used that, so far as our experience goes, almost perfectly protects the wall of the pipe against being eaten away and destroyed by corrosion. There are certain soils and waters, however, fortunately rarely met with, possessed of chemical qualities such that pipe is rapidly destroyed. The drainage water from coal mines has been known to possess this deleterious quality. The action of the electric current, commonly known as electrolysis, under certain conditions, seriously weakens a pipe system. A few years ago this was considered a great source of danger to our distribution systems. It has been subsequently learned that the danger from this cause is confined to the spot where the current leaves the pipe, and thus only a small part of the pipe system is affected, even in aggravated cases. Furthermore, it is now known that electrolysis may be corrected by proper bonding in the electrical construction.

Certain waters produce a deteriorating effect owing to a tendency to produce tubercles or incrustation upon the interior surface of the pipe, which tends to reduce its carrying capacity. This obviously has effect upon the usefulness of the pipe and its value. Means have lately been introduced for cleaning water mains that have become depreciated from this cause, and it is probable that deficiencies due to tuberculation will not hereafter be considered as serious as formerly. Very little trouble is experienced in the central west owing to tuberculation or incrustation of the water mains. Our waters are much more satisfactory in this respect than the softer waters of the east.

Aside from the pipe system, there are usually other structures having, under favorable conditions, a very long life. Reservoirs constructed of permanent materials, such as masonry or earth, come under this class. They are almost indestructible when properly maintained, and their depreciation is usually confined to coverings or other parts of non-permanent character.

Steel reservoirs, standpipes or elevated tanks have a much shorter life. Many of our standpipes are now 20 to 30 years old, and although some of them are in fairly good condition, a number have been taken down as being dangerous, have been destroyed by accident or have been displaced through lack of capacity.

Buildings are of uncertain life, and are usually displaced from lack of utility rather than deterioration in their structure.

Pumping machinery has a variable life. As regards the pumping engine, it is more often replaced through lack of capacity than for perhaps any other reason. Good machines, fitted to their condition, have been known to operate for 50 years, more or less actively, and it is probable that any good machine, well maintained, is capable of service for a very long period where conditions of service permit its continued use. Most pumping engines, and this is true of many other water works devices, have a useful passive life after their active work is done. It is considered necessary in our water works to hold machinery in reserve for use in case of accident, and old machinery of sufficient capacity, in good condition, well suits the demand of this reserve.

In assigning depreciation to any particular case it must be based upon certain assumptions as to the life of the various structures, taking into consideration the local conditions, and while it is impracticable to give any rules that are applicable to all circumstances, it may be said that the estimated life of water works structures, as they have been assigned by appraisal boards in arriving at depreciation, do not differ materially from the following:

ORDINARY LIFE OF WATER WORKS STRUCTURES.

	Years.
Well coated cast iron pipe and specials	75 to 100
Wrought iron pipe, well coated	25 to 50
Hydrants and valves	50 to 75
Buildings	25 to 50
Reservoirs	50 to 100
Standpipes	25 to 50
Pumping machinery	15 to 50
Boilers	10 to 20
Electric machinery	25 to 50

From what has been said as to the generally assumed life of water works structures, it must not be inferred that the depreciation is uniform from the beginning to the end of the life. In fact, this is seldom the case. It is quite conceivable that a pumping engine a few years after its installation, while its capacity is still ample for all purposes and which has been operated for a sufficient length of time to insure that it is substantially built and fitted for its service, may be considered as fully as valuable, if not more valuable, than it was the day that it was installed, when its efficiency had not been demonstrated.

Furthermore, in most structures the depreciation is not uniform, but is slow during early life and rapid toward the end of existence.

Upon the Sheboygan appraisal in 1900 Mr. Bennezette Williams, C. E. suggested the use of the sinking fund in computing the depreciation of water works. The plan was adopted by the board in that appraisal, and it so fits experience in the nature of depreciation as to have been adopted by most appraisal boards that have considered water works values since that time. The working of this plan may perhaps be most clearly seen by an illustration. Let us assume that Smith pays $1,000 for a machine whose life is fixed at 20 years. Knowing its life there can be readily computed the annual addition to a sinking fund, which, at compound interest (say 3 per cent) will replace the machine at the end of its life. If at the end of 10 years Smith sells the machine to Jones, agreeing to turn over with it the accumulation of his sinking fund to date of sale, Jones can afford to pay the original purchase price of the machine, $1,000, the accumulation of the sinking fund having made good such depreciation in the machine as has taken place prior to the transfer. In addition Jones would have the scrap value of the machine, whatever that might be at the end of its life. This is precisely the method pursued in computing depreciation upon the so called sinking fund or curved line basis. It brings experience and theory together in that a reasonable assumption as to the life of a structure may be made, and a result reached in accord with experience in that the depreciation during the early years of life is small, increasing more rapidly as the end of life is approached. In applying this method of computation it has been customary, knowing the age and assuming the life of a structure, to compute the accumulation of an annual sinking fund sufficient to replace the structure at the end of its life up to the date of appraisal, and deduct such accumulation as depreciation from the cost of duplicating the structure.

In supplying this method of computation it would be perfectly proper to deduct from the cost of duplicating the structure its scrap value at the end of its life before computing the sinking fund. This method of procedure is actually pursued in financial reports upon commercial enterprises, but inasmuch as the scrap value of most water works appliances is small, after they have lived their life, this refinement has usually not been introduced in the appraisal of water works property.

GOING VALUE.

Our courts have held in several important cases where a city compels a company to part with its property that in determining the remuneration to be paid by the city, consideration shall be given not only to the physical value of the property but to the added value that it has from the fact that it is in operation, that it is doing business and earning revenue. This element of worth is somewhat analogous to the so called "good will" in the transfer of business properties.

The justice and legality of this element of value was clearly decided in the case of the National Water Works Co. of New York vs. Kansas City, in the circuit court of the United States for the western district of Missouri, and the appeal of this case to the United States Court of Appeals, eighth circuit. In this case the court awarded to the water company a substantial sum in view of the business established. Another decision on this point was made in the case of the Newburyport Water Co. vs. the city of Newburyport by the Supreme Court of Massachusetts, which refused to reverse the finding of the lower court awarding $40,000 for "going value."

In practically all valuations of water works properties that have been made since these decisions were rendered, "going value" or "business value" has been considered a legitimate item of worth.

It remained for Mr. Bennezette Williams, C. E., in the appraisal of the Dubuque water works to suggest a rational method of computing this element of value. The following quoted from the findings of the board of arbitration gives as clear a definition of the matter as the writer has seen:

"Going value consists of the element of earning power which a plant possesses growing out of its having an assured business in excess of what a new plant started without any business would have, and is measured by the sum of the yearly amount of revenue reduced to present value which such plant in operation will produce in excess of what new works of a like character can be made to produce between the time of purchase and that time in the future when the revenues of the two works become equal, proper allowances being made for the difference in cost of maintenance."

Defined in another way, "going value" is a measure of the advantage of purchasing the going plant at its physical value, less depreciation, over and above that of building a new plant of substantially the same kind.

The method of computing values by the means suggested, as it has been applied in recent appraisals, is as follows:

An estimate is made of earnings from domestic sources only, and the operating expenses of the old plant during a period of years subsequent to the date of appraisal. This can be done with some degree of accuracy by an inspection and comparison of the past history of the plant. An estimate must be made of the length of time required to construct a new plant substantially the same as the old. This period will vary from one to three years, depending upon the magnitude of the property. An estimate must further be made of the probable income from the new plant over a period of years subsequent to its completion, supposing that the new plant starts without consumers and that the business grows at a reasonable rate until the revenues of the new and old plant are equal. The operating expenses of the new plant must also be computed during this period whose length has been variously estimated by different appraisers in valuing different works at from six to twelve years. Having made these estimates the appraiser is in a position to set down the debit and credits. The old works must be credited with its earnings from the date of appraisal to the time when the earnings of the two plants are equal. To this must be added the hydrant rental during the time of construction of the new plant, after which it is assumed that the city has the right to transfer this source of revenue to the new plant. Against the above credit for a period of years must be set the following debits:

First, the domestic earnings of the new plant up to the time that the earnings of the two plants are equal.

Second, the difference in the operating expenses between the new plant and the old plant, as obviously the new plant during its early life, with its comparatively small consumption, will be operated at a less cost than the old; and.

Third, the difference in interest during the period of constructing the new plant, as compared with the interest upon the old plant during the same period. The total debit deducted from the total credit for each year up to the time when the revenues from the two plants are equal, gives the annual going value, and these annual going values reduced to their present worth, at a reasonable rate of interest (5 per cent is commonly used), and footed up gives us the present going value of the property.

It will not be inferred that the method of computation above described eliminates in any way the necessity for careful study and the exercise of sound judgment in its application to any particular case. A trial will demonstrate that a few variations in the assumptions are fruitful of large results in the outcome. It has the advantage over a direct assumption as to the going value, in that rational assumptions applied to plants of various cost and income produce harmonious and consistent results, and a number of cases now exist where this rather troublesome element of value has been computed by this general method with the entire satisfaction of both the buyer and seller.

This value is not, as might possibly be supposed, entirely a fictitious value. In a large majority of water works plants it represents money actually expended in building up the business. There are few plants that pay operating expenses during the years closely following the installation, and it is usually a considerable time, even under favorable circumstances, before a plant can be expected to give a full return upon operation, interest and depreciation. It is for this reason that we must credit a plant with a reasonable going value, not only in cases of prospective transfer between company and municipality but also in the case of valuation for the purpose of fixing rates.

FRANCHISE VALUE.

The franchise is the company's right to exist and transact business. Without it operation may not continue. Hence it is difficult to contend that a good franchise is without value. The value of the franchise was early recognized, and in many franchises, granted in the early '80's and before, the documents contained provisions whereby the franchise value should be waived and not considered in the event of valuation for purchase by the city. These prohibitory clauses in the early ordninances have been considered as good and binding by both court and boards of appraisal. In a large majority of the cases that have come under consideration the franchise has been without value, owing to its having expired or being about to expire.

Furthermore, a good franchise that fails to show earnings over and above operating expenses, interest and sinking fund charges sufficient to retire the property at the end of the franchise is generally considered to have a nominal value only. This narrows franchise values down to a very few plants operating under exceptional circumstances and valued at exceptional times in the life of the franchise.

A rational method that has been used in assisting judgment to place a value upon such a franchise is as follows:

An estimate must be made of the gross earnings of the property during the remainder of the franchise life. As in the computation incident to the going value, these figures may be approximated by an inspection of the past history of the plant, coupled with judgment as to the future conditions. From the yearly gross revenues must be deducted the operating expenses for each year, including maintenance, taxes, etc., and further, the annual contribution to a sinking fund which will retire the property at the end of the franchise. If after these deductions are made a credit still remains these credits may be reduced to their present worth and footed, giving a sum which, if the assumptions have been proper, fixes the reasonable value of the franchise.

Franchise values have of late years been somewhat affected by the laws passed in several of our western states whereby municipalities have the right to fix upon reasonable rates, subject to review by the court upon demand. The court holds, however, that the company is entitled to a reasonable return upon its investment; that a reasonable return consists in operating expenses, including maintenance and taxes, a reasonable interest return, an annual contribution to a sinking fund sufficient to retire the property at the end of its life, and in addition and above these charges a profit that would reasonably warrant the hazard of the investment.

It is the writer's opinion, based upon court decisions, that from 2 to 4 per cent profit over and above the charges mentioned should not be considered unreasonable, in this part of the country. With interest at 5 per cent the total return to the investor, interest and profit, would range between 7 and 9 per cent. This profit, although apparently small, applied to a good franchise with a number of years to run by the method above outlined produces a very fair franchise value. It should be said, however, that the properties producing sufficient revenues to show franchise values are comparatively scarce.

Life of Railway Cars and Locomotives, and Cost of Repairs.

In the Railroad Gazette, Oct. 11, Mr. William Mahl, comptroller of the Union Pacific and Southern Pacific railways, gives some valuable data as to the life of equipment on the Southern Pacific Railway.

The following are averages for the period of six years, 1902 to 1907, the costs being the average cost per year:

Class.	Number. Serviceable.	Expenditure on each per annum. Repairs.	Vacated.
Locomotives	1,540	$3,165	$183
Passenger cars...	1,504	759	104
Freight cars.....	42,983	70	17

In "repairs" are included the annual expenditure for repairs and renewals of each locomotive or car, other than the expenditure for equipment "vacated." In "vacated" is included the cost of equipment destroyed, condemned and dismantled, sold or changed to another class. In 1903 there was a fire which destroyed $225,000 worth of passenger cars, bringing up the cost per car "vacated" to $234 for that year, as against an average of $82 per car per year for the other five years of the period. Hence the $104 for passenger cars "vacated," as above given, is probably too high for a fair average.

From 1891 to 1907, a period of 17 years, the average number of freight cars "vacated" each year was 3.63% of the total number in service. Dividing 100 by this 36.3, we get 27½, which is, therefore, the average life in years of each freight car. These cars were nearly all wooden cars, of which the cost of a box car did not exceed $450, excluding air brakes.

In the six-year period (1902 to 1907) the following was the record of equipment vacated:

	Locomotives.	Cars.—Passenger.	Freight.	Road Service.
Total number.	294	299	11,797	468
Avg. price per locomotive or car:				
Credited to replacement fund	$9,298	$1,228	$553	$567
Charged to operating exp.	5,742	3,140	372	380
Proceeds from sale or salvage	3,556	1,087	180	188

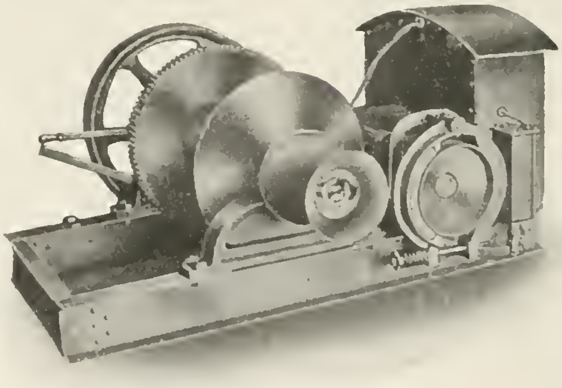
Since there were 294 locomotives "vacated" in six years, the average was 49 per year out of the 1,540 in service, or 3.2%, which is equivalent to a life of 31 years. The life of passenger cars was practically the same.

There were nearly 2,000 freight cars "vacated" per year out of an average of 42,983 in service, or nearly 4.7%, which is equivalent to a life of but little more than 21 years. But in the years 1906 and 1907 6,338 cars were vacated, which is more than half of all vacated in the six-year period, indicating an unusual amount of replacement. This is also borne out by the fact that for the 17-year period the life of freight cars averaged 27½ years, as above stated.

Of course, the life of railway equipment depends not only upon the depreciation due to wear and tear, but upon the fact that light equipment is profitably replaced by heavier equipment.

An Improved Electric Hoist for Contractors.

The electric hoist offers a number of possible advantages over hoisting engines for many kinds of contract work. Their great fault has been, as they have usually been designed, that they could not stand up successfully under the rough usage of such work. Dirt and water, careless handling and ignorant operation so often put them out of commission that they were not the dependable machine that was needed. In the electric hoist illustrated here, these common faults have been kept in mind and avoided. The mechanism is so designed that the hoist cannot "burn out" whatever the condition of the loading may be, and by encasing the machinery dirt and water cannot get at it and put it out of order. Finally, its control is possible from any part of the work. Thus in building work the hoist can be located on the ground level while the operator is stationed on some story above where work is in progress. In this way the operator can be in sight of his load and can manipulate it with judgment and perfect safety. The hoist is manufactured by the Inter-State Equipment & Engineering Co., of Chicago, Ill.



The Grable Electric Material Hoist for Contractors.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0396. **Feed Water Heaters.**—The Marion Incline Filter & Heater Company, Marion, Ohio.

This is an unusually well gotten up descriptive catalog relating to the advantages of feed water heating and the special merits of the feed water heaters manufactured by the firm named. Questions of what design of heater offers greatest economy, oil separation, etc., are discussed. Drawings and illustrations are given showing the application of the system of heating and purification controlled by this company.

No. 0410. **Reinforced Concrete.**—Turnbull Construction Co., New York and Philadelphia.

This is an illustrated pamphlet on the design and use of concrete steel by J. Reygondeau de Gratresse, vice president of the Turnbull Co. Numerous buildings, bridges, etc., that the company has built are illustrated.

No. 0411. **Chains.**—S. G. Taylor Chain Co., Chicago, Ill.

This is a catalog and price list of a complete line of chains manufactured by the firm named. Each kind of chain is illustrated and the illustrations are accompanied by tables giving the sizes made and for each size the strength in tons and the weight. The chains range in character from those intended for the heaviest kind of work to very small sizes such as are used for halters and similar purposes.

No. 0412. **Door Hangers.**—The Richards Mfg. Co., Aurora, Ill.

This is a catalog and price list of the very complete line of hangers and special hardware for rolling doors manufactured by the company named. The several types and sizes of hangers are illustrated and briefly described and prices are given in each case.

No. 0413. **Refrigerating Machinery Fittings.** De La Vergne Machine Co., New York, N. Y.

This catalog is devoted entirely to the large line of fittings manufactured by this firm for refrigerating machinery. Each style of fitting is illustrated and the illustrations are accompanied by tables of sizes and prices.

No. 0414. **Combination Meters.**—H. W. Johns-Manville Company, New York, N. Y.

The combination meter described and illustrated in this pamphlet is known as the Victor Meter. It is designed particularly for measuring direct current and gives the reading directly in watts or kilowatts and horse-power. The pamphlet illustrates the several types of meter and describes each type in detail. Sizes and prices are also given. There is also a section devoted to Victor Interchangeable Shunts. The pamphlet is well written and excellently illustrated and is worth securing by anyone interested in instruments of this kind.

No. 0415. **Economy Blast Loading System.**—The Cyclone Drill Co., Orrville, Ohio.

This pamphlet illustrates and describes the blast hole loader manufactured by the company named above. The purpose of this loader is to prevent the waste of explosive and also to insure that the explosive is placed at the point where it is wanted. Contractors who have a large amount of heavy blasting in which black powder is used would do well to secure this catalog and study the facts presented.

No. 0416. **Reinforced Concrete.**—Standard Concrete Steel Co., New York, N. Y.

This pamphlet describes a system of reinforced concrete construction in which an independent frame of steel is first erected and then surrounded by the concrete. In building construction, for example, the column and floor reinforcing is erected for an entire floor. Then this steel frame is enclosed in molds which are filled with concrete. The pamphlet presents the advantage of this system of construction and shows a number of construction details for building work. There are also a number of illustrations of buildings in which this system of construction has been used.

No. 0417. **Steam Engines.**—Atlas Engine Works, Indianapolis, Ind.

The engine described in this bulletin is known as the Splash Oiling Single Valve Engine, which is especially designed for direct connection to electric generators and for all classes of work requiring high rotative speed. Sections of the cylinder and valve chest and details of cross heads connecting rods and other parts are given. The descriptive text serves to explain the illustrations and the construction of the engine.

No. 0418. **Steel Wheelbarrows.**—Ohio Steel Wheelbarrow Co., Toledo, Ohio.

This company makes a number of different styles of wheelbarrows, some constructed entirely of steel and others partly of steel and partly of wood. Special barrows are made for handling concrete and mortar, and particular attention is given to the manufacture of contractors' barrows. These contractors' barrows have wooden handles, but the trays, wheels and legs are of steel.

No. 0419. **Pumping Machinery.**—Fred M. Prescott Steam Pump Co., Milwaukee, Wis.

This is a very handsomely printed and illustrated catalog of the general line of pumping machinery manufactured by the firm named. The catalog illustrates and describes mine pumps, condensing apparatus, boiler feed, fire and general service pumps, and pumps for water-works and general pumping purposes. All of the different machines are illustrated by half-tones and line drawings are given of some of them, showing the structural details. Directions are given for installing and operating steam pumps, for setting steam slide valves, and such like work. The pamphlet concludes with a number of useful tables giving properties of saturated steam, pressure of water, hydrant and hose stream data, friction loss, etc.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

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Oct. 23. Philadelphia, Pa. ....Oct. 16
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Oct. 25. Ohiopyle, Pa. ....Oct. 23
Oct. 25. Belvidere, Ill. ....Oct. 23
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Oct. 28. Sulphur Springs, Ind. T...Oct. 16
Oct. 28. Walla Walla, Wash..........Oct. 23
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Oct. 30. Williamsport, Md. ....Oct. 16
Nov. 1. Calgary, Alberta ....Oct. 23
Nov. 4. Ashland, O. ....Oct. 16
Nov. 4. Jasper, Ind. ....Oct. 23
Nov. 4. Angola, Ind. ....Oct. 23
Nov. 5. Millvale, Pa. ....Oct. 16
Nov. 5. Vincennes, Ind. ....Oct. 23
Nov. 5. Paoli, Ind. ....Oct. 23
Nov. 6. Muncie, Ind. ....Oct. 23
Nov. 8. Washington, Pa. ....Oct. 23
Nov. 8. Cincinnati, O. ....Oct. 23
Nov. 8. Redding, Cal. ....Oct. 23
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Oct. 29. Franklin, La. ....Oct. 23
Oct. 30. Terre Haute, Ind..........Sept. 18
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Oct. 30. Columbus, O. ....Oct. 2
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Oct. 31. Kansas City, Mo..........Oct. 9
Oct. 31. New York, N. Y..........Oct. 23
Oct. 31. New York, N. Y..........Oct. 23
Oct. 31. Denver, Colo. ....Oct. 23
Oct. 31. Chicago, Ill. ....Oct. 23
Oct. 31. Milwaukee, Wis. ....Oct. 23
Oct. 31. Peoria, Ill. ....Oct. 23
Nov. 1. St. Croix Falls, Wis.......Oct. 16
Nov. 2. Washington, D. C.........Oct. 23
Nov. 4. Fort Washington, Md......Oct. 9
Nov. 4. Pierre, S. Dak..........Oct. 16
Nov. 5. Bloomfield, Ind. ....Sept. 18
Nov. 5. Bloomfield, Ind. ....Sept. 25
Nov. 5. Flint, Mich. ....Oct. 2
Nov. 5. Portland, Me. ....Oct. 9
Nov. 5. New Orleans, La..........Oct. 16
Nov. 5. Los Angeles, Cal..........Oct. 23
Nov. 6. Luverne, Ala. ....Oct. 16
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Nov. 8. Fort Stevens, Ore. ....Oct. 23
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Nov. 11. Cincinnati, O. ....Oct. 23
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Nov. 12. Pipestone, Minn. ....Oct. 16
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Roads and Streets.

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Oct. 23. Butler, Pa. ....Oct. 16
Oct. 24. Kansas City, Mo..........Oct. 16
Oct. 24. Fort Wayne, Ind..........Oct. 16
Oct. 25. Milwaukee, Wis. ....Oct. 23
Oct. 25. Pittsburg, Pa. ....Oct. 23
Oct. 26. Richwood, O. ....Oct. 9
Oct. 26. West St. Paul, Minn.......Oct. 23
Oct. 28. New Orleans, La..........Oct. 23
Oct. 28. Kansas City, Mo..........Oct. 23
Oct. 28. Kansas City, Mo..........Oct. 23
Oct. 29. Sioux City, Ia..........Oct. 23
Oct. 29. St. Louis, Mo..........Oct. 23
Oct. 30. Cleveland, O. ....Oct. 16
Oct. 30. Indianapolis, Ind. ....Oct. 23
Oct. 30. Brooklyn, N. Y..........Oct. 23
Oct. 30. Des Moines, Ia..........Oct. 23
Oct. 30. Cleveland, O. ....Oct. 23
Oct. 30. Baltimore, Md. ....Oct. 23
Oct. 31. Fort Logan H. Roots, Ark..Oct 9
Oct. 31. Kansas City, Mo..........Oct. 23
Oct. 31. Kansas City, Mo..........Oct. 23
Nov. 1. Cincinnati, O. ....Oct. 23
Nov. 1. North Braddock, Pa.......Oct. 23
Nov. 2. Greencastle, Ind. ....Oct. 23
Nov. 2. Fort Wayne, Ind..........Oct. 23
Nov 4. Peru, Ind. ....Oct. 2
Nov. 4. Salem, Ind. ....Oct. 16
Nov. 4. Jasper, Ind. ....Oct. 16
Nov. 4. Columbus, Ind. ....Oct. 23
Nov. 4. Sandusky, O. ....Oct. 23
Nov. 4. Red Bank, N. J..........Oct. 23
Nov. 4. Sullivan, Ind. ....Oct. 23
Nov. 4. Logansport, Ind. ....Oct. 23
Nov. 5. Millvale, Pa. ....Oct. 16
Nov. 5. Paoli, Ind. ....Oct. 23
Nov. 5. Vincennes, Ind. ....Oct. 23
Nov. 5. Brookville, Ind. ....Oct. 23
Nov. 6. Spokane, Wash. ....Oct. 23
Nov. 7. Rockville, Ind. ....Oct. 16
Nov. 9. Janesville, Wis. ....Oct. 23
Nov. 12. Troy, O. ....Oct. 16
Nov. 12. Harrisburg, Pa. ....Oct. 23
Nov. 15. Pensacola, Fla. ....Oct. 23
Dec. 6. Salt Lake City, Utah.....Oct. 23

Sewers.

Oct. 23. Whiterocks, Utah ....Sept. 25
Oct. 24. Kansas City, Mo..........Oct. 16
Oct. 24. Cedar Rapids, Ia..........Oct. 16
Oct. 24. Cleveland, O. ....Oct. 23
Oct. 25. Lincoln, Ill. ....Oct. 23
Oct. 26. Ingram, Pa. ....Oct. 23
Oct. 28. Aberdeen, S. Dak..........Oct. 9
Oct. 28. Philadelphia, Pa. ....Oct. 23
Oct. 28. St. Paul, Minn..........Oct. 23
Oct. 28. Toledo, O. ....Oct. 23
Oct. 29. Tecumseh, Mich. ....Oct. 16
Oct. 29. Des Moines, Ia..........Oct. 23
Oct. 29. Canandaigua, N. Y.......Oct. 23
Oct. 30. Indianapolis, Ind. ....Oct. 23
Nov. 1. North Braddock, Pa.......Oct. 23
Dec. 3. Auburn, N. Y..........Oct. 16
Nov. 4. Ottumwa, Ia. ....Oct. 23
Nov. 5. Millvale, Pa. ....Oct. 16
Nov. 5. Luverne, Minn. ....Oct. 23
Nov. 7. White Plains, N. Y.......Oct. 23
Dec. 2. Cadillac, Mich. ....Oct. 23

Water Supply.

Oct. 23. Atlanta, Ga. ....Sept. 18
Oct. 25. De Pere, Wis..........Oct. 16
Oct. 25. Antioch, Ill. ....Oct. 23
Oct. 30. Albert Lea, Minn..........Oct. 23
Nov. 4. Tucson, Ariz. ....Oct. 2
Nov 5. New Fort Lyon, Colo.......Oct. 9
Nov. 7. Chilocco, Okla. ....Oct. 16
Nov. 11. Fort Terry, N. Y..........Oct. 23
Nov. 12. Pipestone, Minn. ....Oct. 16
Nov. 14. Fort Mackenzie, Wyo.....Oct. 23
Nov. 15. Phoenix, Ariz. ....Oct. 2
Dec. 1. Phoenix, Ariz. ....Oct. 16
Dec. 17. Camden, N. J..........Oct. 16

Miscellaneous.

Oct. 23. Baltimore, Md., Street Lighting, Sept. 25
Oct. 23. Brooklyn, N. Y., Wood Fences, Oct. 16
Oct. 24. New York, N. Y., Signal System, Oct. 9
Oct. 24. Toccoa, Ga., Concrete Work, Oct. 9
Oct. 24. New York, N. Y., Train Signals, Oct. 16
Oct. 24. Kansas City, Mo., Tree Planting, Oct. 16
Oct. 25. Charleston, S. C., Dredge, Sept. 25
Oct. 25. Milwaukee, Wis., Chimney, Oct. 23
Oct. 26. Salmon River, N. B., Breakwater Extension, Oct. 16
Oct. 28. Atlantic City, N. J., Boardwalk, Oct. 16
Oct. 28. Dayton, O., Cable System, Oct. 23
Oct. 29. Cincinnati, O., Track Work, Oct. 2
Oct. 30. New York, N. Y., Fireboat Repairs, Oct. 23
Oct. 31. Mobile, Ala., Snagboat, Sept. 11
Oct. 31. New York, N. Y., Ferry House, Oct. 16
Nov. 1. Harrisburg, Pa., Stone Removal, Oct. 16
Nov. 1. Fort Schuyler, N. Y., Wharf Work, Oct. 16
Nov. 1. Calgary, Alberta, Street Railway, Oct. 23
Nov. 4. Louisville, Ky., Snagboat Hull, Oct. 9
Nov. 4. Fort D. A. Russell, Wyo., Steel Fence, Oct. 16
Nov. 4. Berrien Springs, Mich., Electric Light System, Oct. 23
Nov. 7. Fort Des Moines, Ia., Fence, Etc., Oct. 23
Nov. 8. Kokomo, Ind., Electric Lighting, Oct. 9
Nov. 8. Kokomo, Ind., Electric Plant, Oct. 16
Nov. 14. New Orleans, La., Monument, Oct. 16
Nov. 15. Charleston, S. C., Street Lighting, Sept. 11
Nov. 16. Charleston, S. C., Concrete Pier, Oct. 23
Nov. 18. Dallas, Tex., Lock and Dam, Oct. 16
Nov. 20. New Orleans, La., Dredge, Oct. 2
Nov. 25. Mobile, Ala., Locks and Dams, Oct. 2

Excavation, Earth and Rock.

Oct. 24. Ortonville, Minn., Ditch, Oct. 16
Oct. 24. Grand Rapids, Mich., Excavating, Oct. 23
Oct. 25. Ivanhoe, Minn. Ditch Work, Sept. 25
Oct. 25. Boone, Ia., Tile Drains, Oct. 23
Oct. 25. Flint, Mich., Foundation Excavation, Oct. 23
Oct. 28. Kansas City, Mo., Grading, Oct. 23
Oct. 30. Newport, R. I., Dredging, Oct. 9
Oct. 30. Brooklyn, N. Y., Grading Lots, Oct. 23
Oct. 31. Waskom, Tex., Railroad Grading, Oct. 23
Nov. 1. National Soldiers' Home, Va., Dredging, Oct. 23
Nov. 7. New Boston, Ill., Ditch and Levee Work, Oct. 16
Nov. 11. Prophetstown, Ill., Ditch Work, Oct. 23
Nov. 15. Philadelphia, Pa., Dredging, Oct. 23
Nov. 16. Pine Bluff, Ark., Levee Work, Oct. 23
Nov. 20. Detroit, Mich., Dredging, Oct. 16

Materials, Machines, Supplies, Tools, Etc.

Oct. 23. New York, N. Y., Nozzles, Tools, Oct. 16
Oct. 23. Brooklyn, N. Y., Portland Cement, Oct. 16
Oct. 23. Owosso, Mich. Boilers, Oct. 16
Oct. 24. New York, N. Y., Electrical Equipment, Oct. 16
Oct. 24. New York, N. Y., Broken Stone, Screenings, Oct. 16
Oct. 26. Chicago, Ill., Arc Lights, Wire, Etc., Oct. 23
Oct. 28. Washington, D. C., Castings, Rope, Etc., Oct. 9
Oct. 28. Ashley, Pa., Fire Hose, Oct. 23
Oct. 28. Kansas City, Mo., Hose Wagons, Oct. 23
Oct. 29. Puget Sound, Wash., Timber, Tubing, Etc., Oct. 9
Oct. 29. Mare Island, Cal., Drills, Cable, Etc., Oct. 9
Oct. 29. Milwaukee, Wis., Telegraph Cable, Oct. 23
Oct. 30. Bay City, Mich., Steam Turbine, Boilers, Etc., Oct. 23
Oct. 30. Baltimore, Md., Motor, Oct. 23
Oct. 31. Cleveland, O., Mechanical Equipment, Oct. 2
Nov. 1. Calgary, Alberta, Street Cars, Oct. 23

Nov. 1.	Augusta, Ga.,	Rails, Ties, Etc.,	Oct. 23
Nov. 4.	Washington, D. C.,	Tanks, Meters, Etc.,	Oct. 9
Nov. 4.	Washington, D. C.,	Tools, Meters, Etc.,	Oct. 9
Nov. 5.	Oceanside, Cal.,	Pumping Engine, Boiler,	Oct. 23
Nov. 5.	Millvale, Pa.,	Truck,	Oct. 23
Nov. 8.	Washington, D. C.,	Pumps, Cement, Etc.,	Oct. 16
Nov. 12.	Washington, D. C.,	Cars, Jacks, Tile, Etc.,	Oct. 23
Nov. 12.	Key West, Fla.,	Boiler,	Oct. 23
Nov. 14.	Fort Morgan, Ala.,	Pumping Plant,	Oct. 23
Nov. 15.	Winnipeg, Man.,	Water Pipe,	Oct. 9
Nov. 18.	Portland, Ore.,	Hoisting Engines, Etc.,	Oct. 23
Dec. 1.	Phoenix, Ariz.,	Water Pipe,	Oct. 16

BIDS ASKED.

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Redding, Cal.—Until 10 a. m., Nov. 8, by S. N. Witherow, Clerk County Supervisors, for constructing bridge over Sacramento river near Castle Crag.

Belvidere, Ill.—Until 4 p. m., Oct. 25, by Scott Clark, Chairman Street and Alley Committee, for constructing reinforced concrete bridge over Kishwauk River at Main St.

Angola, Ind.—Until Nov. 4, by County Auditor, for a 20x14 ft. iron bridge.

Jasper, Ind.—Until Nov. 4, by County Auditor, for constructing steel bridge across Patoka River, steel bridge on Oreland and Sulphur Springs; repairs on Knoxville bridge.

Muncie, Ind.—Until Nov. 6, by J. E. Davis, County Auditor, for constructing bridge across Mississinewa River at Black's Mills and one across Mississinewa River at Granville, also bridge across White River at Smithfield and one across White River at Yorktown.

Paoli, Ind.—Until Nov. 5, by Alvin B. Ham, County Auditor, for erection of bridge in South East Township.

Richmond, Ind.—Until 11 a. m., Nov. 9, by County Commissioners, for the construction of nine bridges and two arches—one each in Jackson, Jefferson, Dalton, Harrison and Franklin Townships, and two in each of Center, Washington and Wayne Townships.

Vincennes, Ind.—Until Nov. 5, by County Auditor, for erection of a number of bridges.

Portland, Ore.—Until 4 p. m., Nov. 15, by A. L. Barlus, City Auditor, for constructing steel bridge on Union Ave.

Indianapolis, Ind.—Until 10 a. m., Oct. 29, by Cyrus J. Clark, County Auditor, for the making and grading of the approaches of the Mt. Nebo bridge in Lawrence Township, to the Hoffman Ford bridge, in Washington Township.

Cincinnati, O.—Until noon, Nov. 8, by Fred Dreihs, Clerk County Commissioners, for reflooring suspension bridge over Whitewater River, near Harrison, O.

Washington, Pa.—Until noon, Nov. 8, by County Controller of Westmoreland County and County Commissioners of Washington County, for erecting joint county bridge over Monongahela River. Bridge is to have five truss spans and two viaduct approaches, total length of steel work,—about 1,550 ft. Roadway,—25 ft. clear, and one sidewalk 6 ft. clear. Plank floor and two electric car tracks. Substructure is to consist of two river piers of stone with concrete foundation, four concrete piers, 14 concrete pedestals, and two concrete abutments. William Wylie, County Engineer, Washington, Pa.

Ohiopyle, Pa.—Until noon, Oct. 25, by Frank Ridgeway, Secy., road Supervisors, Stewart Township, for building abutments to bridge over Meadow Run in Stewart Township.

Walla Walla, Wash.—Until 2 p. m., Oct. 28, by Committee on Streets and Public Improvements, for the construction of a bridge over Mill Creek, in North Fourth St.

Calgary, Alberta, Canada.—Until noon, Nov. 1, by S. J. Clark, Chairman Bd. Pub. Wks., for constructing steel bridge with concrete abutments over the Elbow River. R. E. Speakman is City Engineer.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Dermott, Ark.—Until Oct. 30, by R. E. Buckner, President Board of Education, for construction of public school building.

Los Angeles, Cal.—Until 2 p. m., Nov. 5, by C. G. Keyes, County Clerk, for construction of 1-story brick morgue building at County Hospital, a 1-story frame chapel at County Poor Farm, and a 1-story frame residence at County Poor Farm.

Denver, Colo.—Until 11 a. m., Oct. 31, by Neef Bros. Brewing Co., Commercial Bldg., for furnishing material and labor of all kinds necessary for the construction, erection and delivery of a steel frame, brick addition to above company's brewery.

Washington, D. C.—Until noon, Nov. 2, by District Commissioners, for construction of addition to McKinley Manual Training School. Plans, etc., at Room 43, District Bldg.

Washington, D. C.—Until noon, Oct. 26, by Jay J. Morrow, Engineer Commissioner, for constructing stable in rear of district pumping station on Bryant St., N. W.

Fort Dade, Fla.—Until 8 p. m., Oct. 28, by the Constructing Q. M., for building addition to post engineer's quarters.

Des Moines, Ia.—Until 11 a. m., Nov. 11, by Capt. Jno. J. Boniface, Constructing Q. M., Fort Des Moines, for furnishing and installing electric light fixtures, installing watt meter board, and making service connections in the veterinary stable at Fort Des Moines.

Chicago, Ill.—Until 11 a. m., Oct. 31, by Department Public Works, 322 City Hall, for building brick and stone police station at 115th and Indiana Ave.

Peoria, Ill.—Until 10 a. m., Oct. 31, by Geo. A. Zeller, Superintendent Illinois General Hospital for the Insane, for the construction of two hospital buildings. W. Carbys Zimmerman, State Architect, 1101 Steinway Hall, Chicago.

Franklin, La.—Until Oct. 29, by Wilson McKerrall, for erection of 3-story brick school building.

Fort Crook, Neb.—Until 10 a. m., Oct. 29, by Capt. Joseph F. Gohn, Q. M., for construction of wagon shed.

Fulton, N. Y.—Until Nov. 7, by City Clerk, for installing steam heating plant for City Hall.

Oswego, N. Y.—Until noon, Oct. 28, by W. F. Harrell, Constructing Q. M., Fort Ontario, for constructing addition to quartermaster's stable.

Plattsburg, N. Y.—Until 10 a. m., Oct. 28, by Constructing Q. M., Plattsburg Barracks, for constructing, plumbing and electric wiring a quartermaster's stable and constructing a wagon shed at this post.

Brooklyn, N. Y.—Until 11 a. m., Oct. 28, by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., New York, for installing electric equipment in new public school 5, on Tillary, Lawrence and Bridge Sts., Borough of Brooklyn. Security required is $8,000.

New York, N. Y.—Until 11 a. m., Oct. 28, by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., for installing heating and ventilating apparatus for addition to and alterations in public school 19, on the East side of Greenleaf Ave., between Post Ave. and Floyd St., West New Brighton, Borough of Richmond. Security required is $1,000.

New York, N. Y.—Until 3 p. m., Oct. 31, by Park Board, for furnishing all the labor and materials for completely erecting and constructing a comfort station in the Botanical Garden, in Bronx Park, in the City of New York. Security required is $2,500. Plans at the office of the Department of Parks, Zbrowski Mansion, Claremont Park, Borough of The Bronx.

New York, N. Y.—Until 10:30 a. m., Oct. 31, by Francis J. Lantry, Fire Commissioner, 157 E. 67th St., for additions and alterations to the quarters of engine company 71, Nos. 3134 and 3116 Park Ave. and 159th St. Security required is $3,000. Bids are also asked for additions and alterations to the quarters of engine company 33, located at Nos. 42 and 44 Great Jones St. Security required is $1,500. Also all the additions and alterations to the steam heating plant at quarters of engine company 31, located at Nos. 87 to 91 Lafayette St. Security required $1,400.

Cincinnati, O.—Until noon, Nov. 11, by board of Education, for construction of a new 17-room school building in Westwood, Cincinnati. Garber & Woodward, Architects, No. 508 Neave Bldg.

Fort Stevens, Ore.—Until 2 p. m., Nov. 8, by Constructing Q. M., for construction, plumbing, heating and electric wiring and fixtures of one artillery barrack building for 100 men, at Fort Stevens.

Greenville, Tenn.—Until 11 a. m., Nov. 21, by Major M. Gray Zalinski, Quartermaster, U. S. A., Washington, D. C., for constructing brick lodge and outbuilding, concrete walls and sidewalks, grading, etc., at the Greenville, Tenn., National Cemetery.

Tyler, Tex.—Until 3 p. m., Nov. 25, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of an extension, etc., to the U. S. Post Office and Court House at Tyler, Tex.

National Soldiers' Home, Va.—Until 1:30 p. m., Nov. 7, by John T. Hume, Treasurer, Southern Branch, N. H. D. V. S., National Soldiers' Home, Elizabeth City county, Va., for furnishing all material and labor for constructing a green house.

Portsmouth, Va.—Until 3 p. m., Nov. 22, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the U. S. Post Office and Custom House at Portsmouth, Va.

Milwaukee, Wis.—Until 5 p. m., Oct. 31, by Frank M. Harbach, Secretary Board School Directors, for razing the old school building and to construct and erect a school building on the northwest corner of Forest Home and Eleventh Aves.

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Pensacola, Fla.—Until noon, Nov. 15, by L. Hilton Green, Chairman Bond Trustees, for grading, paving and curbing certain streets, the work including 170,700 sq. yds. of clay or shale blocks, sheet asphalt, bitulithic, wood block or macadam pavement, and 115,950 lin. feet of concrete curb. T. Chalkley Hatton, Chief Engineer, Wilmington, Del.

Sioux City, Ia.—Until 8 p. m., Oct. 29, by E. J. Hanlon, Chairman Street Committee, for constructing cement sidewalks.

Des Moines, Ia.—Until 11 a. m., Oct. 30, by Board Public Works, for improvement of several streets by paving and curbing.

Paoli, Ind.—Until 2 p. m., Nov. 5, by A. B. Ham, County Auditor, for construction of 1,483 ft. of gravel or macadam road in French Lick Township.

Brookville, Ind.—Until 2 p. m., Nov. 5, by Chas. A. Miller, County Auditor, for constructing 4,000 ft. of gravel road.

Columbus, Ind.—Until 10 a. m., Nov. 4, by John Davis, County Auditor, for construction of 4,761 ft. of gravel road in Columbus Township.

Fort Wayne, Ind.—Until 10 a. m., Nov. 2, by George W. Lindemuth, County Auditor, for construction of 9,563 ft. of macadam road in Madison Township.

Greencastle, Ind.—Until noon, Nov. 2, by C. C. Hurst, County Auditor, for improvement of 16,340 ft. of gravel road in Russell Township and 10,560 ft. of Macadam road in Monroe Township.

Indianapolis, Ind.—Until 10 a. m., Oct. 30, by Board Public Works, for improving South Audubon Road by grading and paving sidewalks with cement.

Logansport, Ind.—Until 10 a. m., Nov. 4, by Geo. W. Cann, County Auditor, for constructing gravel roads as follows: In Jackson township, 1¾ miles long; a gravel road in Bethlehem Township, 14,800 ft. long; three gravel roads in Clinton Township, and the construction of a gravel road in Bethlehem Township, 2¼ miles in length.

Sullivan, Ind.—Until noon, Nov. 4, by E. E. Russel, County Auditor, for construction of 9,090 ft. of stone road in Hamilton Township.

Vincennes, Ind.—Until 2 p. m., Nov. 5, by John T. Scott, County Auditor, for construction of 104,602 ft. of gravel roads in Decker Township.

New Orleans, La.—Until 1 p. m., Oct. 28, by City Engineer, for repaving portion of Dryades St. with small granite blocks.

Baltimore, Md.—Until 11 a. m., Oct. 30, by Commissioners for opening streets, Hoen Bldg., to grade, curb, gutter and pave with vitrified brick, bithulithic, asphalt block or sheet asphalt, 28th St., from Calvert St. to St. Paul St.

West St. Paul, Minn.—Until 2 p. m., Oct

26, by Charles Bosse, City Clerk, at office of Louis H. Peter, 59 E. 5th St., St. Paul, Minn., for grading Brompton St.

Kansas City, Mo.—Until 11 a. m., Oct. 31, by E. A. Harper, City Engineer, for construction of artificial stone curbing on portions of 9 streets.

Kansas City, Mo.—Until 11 a. m., Oct. 31, by E. A. Harper, City Engineer, for grading portions of 14 streets and alleys.

Kansas City, Mo.—Until 3 p. m., Oct. 28, by Frank P. Gossard, Secy. Park Commissioners, City Hall, for grading portion of boulevard along Lydia Ave.

Kansas City, Mo.—Until 3 p. m., Oct. 28, by Frank P. Gossard, Secy. Park Commissioners, City Hall, for grading driveway along 26th St.

St. Louis, Mo.—Until noon, Oct. 29, by W. B. Dryden, Secy. Bd. Local Improvements, for improvement of various streets.

Red Bank, N. J.—Until 6 p. m., Nov. 4, by A. C. Harrison, Clerk Commissioners, for paving portions of Front St. and Broad St. Geo. D. Cooper, Red Bank, is Engineer.

Brooklyn, N. Y.—Until 11 a. m., Oct. 30, by Bird S. Coler, Borough President, for work under seven contracts for regulating and paving with asphalt.

Cincinnati, O.—Until noon, Nov. 1, by Fred Dreihs, Clerk County Commissioners, for improvement of Hamilton Pike.

Cleveland, O.—Until 11 a. m., Oct. 30, by Julius C. Dorn, County Clerk, for repairing pavement on Wooster Pike in Middleburgh and Strongsville Townships.

Sandusky, O.—Until 1 p. m., Nov. 4, by Charles Kubach, County Auditor, for labor and material for stoning 6,305 ft. of Venice Road, requiring 1,734 tons of crushed stone.

Harrisburg, Pa.—Until Nov. 12, by State Highway Department, for constructing 6,427 ft. of 16-ft. wide macadam road in Ashton Township, Delaware County.

North Braddock, Pa.—Until 3 p. m., Nov. 1, by C. A. Stewart, Borough Engineer, for improvement of Cliff St., work including 625 cu. yds. of excavation, 1,800 lin. ft. of curb, and 2,100 sq. yds. brick paving.

Pittsburg, Pa.—Until noon, Oct. 25, by F. P. Booth, County Controller, for constructing flagstone sidewalk along 6th Ave. frontage of jail lot.

Greenville, Tenn.—See Under Bids Asked—Buildings.

Salt Lake City, Utah.—Until 8 p. m., Dec. 6, by Board Public Works, L. C. Kelsey, City Engineer, for grading, curbing and paving First South St., the work including the following: Grading, 60.000 cu. yds.; curbing, 17,000 lin. ft.; asphalt pavement, 41,000 sq. yds.

Spokane, Wash.—Until 11 a. m., Nov. 6, by Lieut. B. T. Scher, Constructing Q. M., Fort Wright, Wash., for installing concrete curbing for roads at that post.

Janesville, Wis.—Until 2 p. m., Nov. 9, by Street Assessment Committee, S. B. Heddles, Chairman, for construction of cement gutters and combined curb and gutter on Chatham St.

Milwaukee, Wis.—Until 10:30 a. m., Oct. 25, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for constructing brick sidewalk in front of fire engine house No. 21.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Lincoln, Ill.—Until 2 p. m., Oct. 25, by Board Local Improvements, for construction of 3,045 ft. of 15 in. vitrified pipe sewer in Kankakee St.

Indianapolis, Ind.—Until 10 a. m., Oct. 30, by Board Public Works, for constructing Main sewer in 20th St.; bids are also asked for constructing three local sewers.

Des Moines, Ia.—Until 11 a. m., Oct. 29, by Board Public Works, for constructing septic tank.

Ottumwa, Ia.—Until 8 p. m., Nov. 4, by City Engineer, for constructing several sewers of a total length of about 6,000 ft.

Cadillac, Mich.—Until noon, Dec. 2, by George Johnston, Clk. Bd. Pub. Wks., for building sewage purification works and pumping station.

Luverne, Minn.—Until Nov. 5, by E. C. Schwartz, City Recorder, for constructing sewer in parts of Cedar, Dodge, McKenzie, Van Eps and Spring Sts.

St. Paul, Minn.—Until 2 p. m., Oct. 28, by R. L. Gorman, Clk. Bd. Pub. Wks., for constructing sewer in Pascal Ave. and Lincoln Ave.; also sewer in Ravoux St.

Auburn, N. Y.—As mentioned in our last issue bids are being asked until Dec. 3, by this city for constructing several sewers. The work includes 14,700 ft. of 8 in., 11,300 ft. of 10 in., 6,000 ft. of 12 in., 3,600 ft. of 15 in., 300 ft. of 18 in., 1,250 ft. of 20 in. Disposal works are also to be constructed, consisting of reinforced concrete, septic tanks and contact beds, and automatic appliances for dosing them. In addition there will be 17,000 of 5 in. vitrified tile house sewer connections, and subsoil drains as follows, to be laid underneath the main trench: 20,000 ft. of 4 in., 6,000 ft. of 6 in., 7,000 ft. of 8 in., 2,000 ft. of 10 in., 200 ft. of 12 in. J. Walter Ackerman is City Engineer.

Canandaigua, N. Y.—Until 8 p. m., Oct. 29, by F. P. Warner, Pres. Street Commissioners, for constructing sanitary sewer in Gorham St.

White Plains, N. Y.—Until 1:30 p. m., Nov. 7, by Frank N. Glover, Secy. Bronx Valley Sewer Commission, 2 Grand St., White Plains, for construction of each one of the seven sections which together comprise about 12 miles of circular sewer from 3 1-3 to 6 ft. in diameter and about three miles of circular lined tunnel, mostly 6½ ft. and 8½ ft. in diameter. The material to be either monolithic reinforced concrete, reinforced concrete blocks or brick masonry. Official advertisement will be found elsewhere in this issue.

Cleveland, O.—Until noon, Oct. 24, by A. R. Callow, Secy. Bd. Pub. Wks., for constructing sewer in Barkwill Ave., and in W. 65th St.

Toledo, O.—Until noon, Oct. 28, by Reynold Voit, Secy. Bd. Pub. Wks., for extension of main sewer number 8.

North Braddock, Pa.—Until 3 p. m., Nov. 1, by C. A. Stewart, Borough Engineer, for constructing 240 ft., 12 in., and 486 ft. 8 in. pipe sewer, etc.; also for lowering sewer in Grandview Ave., consisting of 175 ft. 15 in. and 250 ft. 8 in. pipe, etc.

Ingram, Pa.—Until 5 p. m., Oct. 26, by D. H. Hainer, Borough Clerk, for constructing 8 in. sewer in Rugby Ave.

Philadelphia, Pa.—Until Oct. 28, by George K. Stearns, Director Pub. Wks., for constructing sewer.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Antioch, Ill.—Until 7:30 p. m., Oct. 25, by L. M. Hughes, Clerk Village Trustees, for material and labor for water works, including steel work of water tower to be erected on substructure furnished by village. Geo. C. Morgan, Engineer, 808 Royal Insurance Bldg., Chicago, Ill.

Albert Lea, Minn.—Until 8 p. m., Oct. 30, by Wm. Barneck, City Engineer, for constructing 564 ft. of 10 in. water main.

Fort Terry, N. Y.—Until 11:30 a. m., Nov. 11, by Capt. Wm. E. Horton, Constructing Q. M., for sinking 6 in. tubular well at this post.

Fort Mackenzie, Wyo.—Until 10 a .m., Nov. 14, by Capt. Wm. D. Davis, Constructing Q. M., for constructing an 8-in. cast-iron water main from U. S. reservoir to Fort Mackenzie, Wyo., together with connection to post distributing system.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

Pine Bluff, Ark.—Levee Work.—Until 11 a. m., Nov. 16, by Capt. Wm. D. Connor, U. S. Engrs., Riegler Bldg., Little Rock, Ark., for 248,000 cu. yds. of levee work opposite Pine Bluff on Arkansas River, Ark.

Boone, Ia.—Tile Drains.—Until 1 p. m., Oct. 25, by E. F. Jones, County Auditor, for construction of county drain No. 38, including 725 ft. 14 in. tile, 1,000 ft. 12 in. tile and 1,200 ft. 10 in. tile.

Prophetstown, Ill.—Ditch Work.—Until 1 p. m., Nov. 11, by Commissioners of Big Slough Special Drainage District, for enlargement of main ditch, requiring removal of 353,000 cu. yds. of material. F. W. Sears, Engineer, Prophetstown, Ill.

Flint, Mich.—Foundation Excavation.—Until Oct. 25, by D. E. Newcombe, City Clerk, for excavation and footings for city hall building.

Grand Rapids, Mich.—Excavating.—Until 8 p. m., Oct. 24, by S. A. Freshney, Secy. Bd. Pub. Wks., for constructing dock line and excavating for flood protection from Grand River.

Kansas City, Mo.—Grading.—Until 3 p. m., Oct. 28, by Frank P. Gossard, Secy. Park Commissioners, City Hall, for grading land in Swope Park for dams, lagoon and lake.

Brooklyn, N. Y.—Grading Lots.—Until 11 a. m., Oct. 30, by Bird S. Coler, Borough President, for five contracts for grading lots, the work involving a total of 1,976 cu. yds. excavation and 3,006 cu. yds. of filling.

Philadelphia, Pa.—Dredging.—Until noon, Nov. 15, by Maj. J. C. Sanford, U. S. Engrs., Witherspoon Bldg., Philadelphia, for dredging in Delaware River, in Sections 4 and 5.

Waskom, Tex.—Railroad Grading.—Until Oct. 31, by E. H. Ludlow, Chief Engineer, Waskom, for the grading of the first seven miles of the Shreveport & Gulf R. R.

National Soldiers' Home, Va.—Dredging.—Until 1:30 p. m., Nov. 1, by John T. Hume, Treasurer, Southern Branch, N. H. D. V. S., National Soldiers' Home, Elizabeth City County, Va., for dredging channel extension, Jones' Creek, 4,800 cu. yds., more or less.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Des Moines, Ia.—Fence, Etc.—Until 11 a. m., Nov. 7, by Capt. John J. Boniface, Constructing Q. M., for the construction of corral fences and erection of picket lines at Fort Des Moines.

Berrien Springs, Mich.—Electric Light System.—Until 2 p. m., Nov. 4, by Loren B. Marquissee, Village Clerk, for furnishing material and constructing an electric light system, exclusive of power plant.

New York, N. Y.—Fireboat Repairs.—Until 10:30 a. m., Oct. 30, by Francis J. Lantry, Fire Commissioner, 157 E. 67th St., for furnishing all the labor and materials required for repairs and alterations to fireboat "Abram S. Hewitt" (Engine 77).

Dayton, O.—Cable System.—Until noon, Oct. 28, by C. N. Greer, Clerk Bd. Pub. Safety, for installing underground conduit and cable system and exchange improvements for the police and fire departments.

Charleston, S. C.—Concrete Pier.—Until 11 a. m., Nov. 16, by Bureau of Yards and Docks, Navy Department, Washington, until 11 a. m., Nov. 16, for constructing a reinforced concrete wooden pile and timber deck pier at the U. S. Navy Yard, Charleston.

Greenville, Tenn.—Concrete Walls.—See Under Bids Asked—Buildings.

Milwaukee, Wis.—Chimney.—Until 10:30 a. m., Oct. 25, by Charles J. Poetsch, Chairman Bd. Pub. Wks., for building the shaft of a chimney for the Kinnickinnic River flushing works pumping station.

Calgary, Alberta, Canada.—Street Railway.—Until noon, Nov. 1, by S. J. Clark, Chairman Bd. Pub. Wks., for the construction of about 12 miles of street car track and overhead trolley work in the city. R. E. Speakman, City Engineer.

Materials, Machines, Supplies, Tools Etc

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Morgan, Ala.—Pumping Plant.—Until 2 p. m., Nov. 14, by Capt. L. F. Garrard, for the construction of building and pump-house, installing two horizontal tubular boilers (50 H. P.), two compound duplex pumps, ice plant and cold storage.

Oceanside, Cal.—Pumping Engine, Boiler.—Until 7 p. m., Nov. 5, by H. D. Brodie, City Clerk, for cross-compound, high duty pumping engine of 1.000 gallons capacity and for one horizontal return tubular boiler 48 ins. in diameter and 16 ft. long.

Washington, D. C.—Cars, Jacks, Tile, Etc.—Until 10:30 a. m., Nov. 12, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing track-laying cars, journal jacks, motor, draintile, iron, steel, rivets, chain, wire rope, hose, hose reels, hose nozzles, pulleys, tongs, pliers, pinch bars, wrenches, bench screws, set screws, door clamps, stocks and dies, vises, saws, shears, spades, oilstones, tallow pots, platform scales, torches, stovepipe, stencils, rules, drawer pulls, twist drills, glass cutters, oilers, screws, nails, tacks, staples, belt rivets, sponges, twine, tolet paper; cylinder, engine, mineral and neat's-foot oils; lubricating grease, cotton waste, rosin, plaster paris, sal soda, sal Ammoniac, maple and basswood lumber, etc.

Key West, Fla.—Boiler.—Until 9 a. m., Nov. 12, by Quartermaster, Key West Barracks, Fla., for furnishing one 125 H. P. steam boiler.

Augusta, Ga.—Rails, Ties, Etc.—Until noon, Nov. 1, by the Commanding Officer, Augusta Arsenal, for rails, switches, ties, trolley wire and poles for 1,600 ft. spur track.

Bay City, Mich.—Steam Turbine, Boilers, Etc.—Until 3 p. m., Oct. 30, by City Comptroller, for supplying city with a steam turbine, generator, exciter, switchboard, boilers (Scotch type), and lamps, to re-establish the city's electric plant, according to the specifications on file in the office of the Superintendent of Electric Light.

Chicago, Ill.—Arc Lights, Wire, Etc.—Until 11 a. m., Oct. 26, by William Carroll, City Electrician, Room 12, City Hall, for furnishing: 2,500 alternating current, series, arc lamps; 10 single phase, 60 cycle, oil insulated, self-cooled, step-down transformers; 50 inductive regulators; 125 miles, approximately, of No. 6, B. & S. gauge, triple braid, weatherproof, copper, line wire; 150, or more, combination cast iron and steel electric light arc lamp posts.

Baltimore, Md.—Motor.—Until 11 a. m., Oct. 30, by Edward D. Preston, Inspector of Buildings, City Hall, for 60 H. P. shunt field control, direct current, 440 volt motor for New Eastern Female High School.

Kansas City, Mo.—Hose Wagons.—Until 2 p. m., Oct. 28, by John S. Landes, City Purchasing Agent, for furnishing two fire hose wagons for the Fire Department.

Ashley, Pa.—Fire Hose.—Until Oct. 28, by Borough Clerk, for furnishing fire hose.

Portland, Ore.—Hoisting Engines, Etc.—Until 11 a. m., Nov. 18, by Lt. Col. S. W. Roessler, U. S. Engrs., for furnishing and delivering four hoisting engines, three locomotives and two boilers. Official advertisement will be found elsewhere in this issue.

Millvale, Pa.—Truck.—Until 3 p. m., Nov. 5, by H. H. Dixon, Borough Clerk, for supplying fire department with hook and ladder truck.

Milwaukee, Wis.—Telegraph Cable.—Until 10:30 a. m., Oct. 29, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for furnishing for use of fire department, 6,000 ft. of 5-pair cable, 9,300 ft. of 10-pair cable, 7,700 ft. of 20-pair cable, 600 ft. of 25-pair cable and 600 ft. of 30-pair cable.

Calgary, Alberta, Canada.—Street Cars.—Until noon, Nov. 1, by S. J. Clark, Chairman Bd. Pub. Wks., for furnishing city with six semi-convertible cars, with electrical equipment.

CONTRACTS LET.

The following contracts have been let recently:

Gadsden, Ala.—Paving.—Leslie L. Lockwood Co., Bessemer, Ala., at $38,329, for paving several of the business streets. Contract includes 20,000 sq. yds. cement sidewalk and 30,000 lin. ft. combined curb and gutter.

Bisbee, Ariz.—Sewer System.—Chick & White, Berkeley, Cal., at $77,722.

Colusa, Cal.—Bridge Work.—J. M. Peart & Son, at $4,040 for 572 ft. extension of wooden trestle known as Hannum Bridge; Western Bridge & Construction Co., at $7,727, for steel bridges, also at $1,444 for reinforced concrete bridge in Sycamore; W. C. Elean at $1,525 for two reinforced concrete culverts in Grimes.

Sacramento, Cal.—Bridge.—Western Bridge & Construction Co., at $68,750, for steel bridge at Fair Oaks.

San Diego, Cal.—Bridge. — Mercereau Bridge & Construction Co., Los Angeles, Cal., at $11,840, for bridge at Lakeside.

Willows, Cal.—Bridge.—Pacific Construction Co., at $22,557 for steel bridge over Willows.

Chariton, Ia.—Sewers.—G. W. Ensley for 3,800 ft. of sewer.

Pekin, Ill.—Bridge.—Walter Porter, Mackinaw, Ill., at $999 for bridge over McClellan Creek.

Clinton, Ind.—Sewer System.—Morgan & Slinkard, at $64,000.

Evansville, Ind.—Bridges.—Bennett Whitehead, for three county bridges as follows: Hahlin bridge, $1,045; Stafford bridge, $1,055; Langelson bridge, $1,365.

Evansville, Ind.—Road.—McKinney Bros., Sheridan, Ind., at $5,490, for 2½ miles of gravel road.

Greencastle, Ind.—Roadwork.—J. F. Curran at $3,170, for the Hessler Road; Keegan Bros., Brazil, Ind., at $6,298, for J. E. O'Hain road.

Indianapolis, Ind.—Paving, Sidewalks.—Marion Caldwell, 145 E. Market St., cement sidewalks on Julian Ave.; Henry Maag, cement walks on Meridian Ave.; Geo. W. McCray, Baldwin Bldg., brick roadway on Eden Pl.; Geo. W. McCray, brick roadway in alley; Chas. M. Cross, graded roadway and walks in Hawthorne Lane.

Greenfield, Ind. — Bridges. — Greenfield Bridge & Sewer Co., Greenfield, at $1,460, for four bridges.

Lafayette, Ind.—Building.—W. P. Jungclaus Co., Indianapolis, Ind., at $89,890, for experiment station at Purdue.

Concordia, Kans.—Bridges.—Canton Bridge Co., Canton, O., at $5,967, for five county bridges.

Independence, Kan.—Steel Buildings.—Kansas Natural Gas Co. has closed contract with the Southwestern Bridge Co., Joplin, Mo., for four additional steel buildings.

Shreveport, La.—Steel Work.—Contract for the steel work in the Allen Building has been awarded to Southwestern Bridge Co., Joplin, Mo.

Adams, Mass.—Power Line.—Fred T. Ley & Co., Springfield, Mass., at $65,000, for erecting high tension power line for Berkshire Street Ry. Co., from Pittsfield to the Zylonite power station.

Boston, Mass.—Paving.—Jones & Meehan, 10 Tremont St., at about $15,000, for paving and regulating Northern Ave. Contract calls for 6,500 sq. yds. of granite blocks.

Duluth, Minn.—Sewer.—Anderson & Johnson, at $6,346, for building Cedar Ave., and Belknap St. sewer.

St. Paul, Minn.—Bridge.—Bayne & Hewitt, Minneapolis, at $40,000, for bridge at Minnesota Soldiers' Home.

Vicksburg, Miss.—Bridge.—W. T. Young Bridge Co., at $3,795, for cemetery road bridge.

Springfield, Mo.—Roofing.—A. C. Penniman & Sons, Fort Scott, Kan., for roofing new $1,000,000 shops of Frisco Ry., at Springfield.

St. Louis, Mo.—Gravel.—John W. Thompson, Wainright Bldg., for supplying about 1,000,000 cu. yds. of gravel for ballast on the Frisco's new line between New Orleans and Houston. Gravel will be obtained from an island near Baton Rouge, La., where a large plant has been installed.

Springfield, Mo.—Contract has been awarded to Southwestern Bridge Co., Joplin, Mo., for 100,000 gallon tank and tower for the St. Louis & San Francisco R. R., at Springfield.

Joplin, Mo.—Bridges.—Southwestern Bridge Co., Joplin, Mo., has been awarded contracts for bridges required on the line of Joplin & Pittsburg Interurban R. R.

Belleville, N. J.—Sidewalks.—Keystone Construction Co., East Orange, N. J., at $4,000, for laying sidewalks on Washington Ave.

Newark, N. J.—Bridge.—McMullen & McDermott Park Row Bldg., New York, for substructure of new bridge over Hackensack River to carry New York & Greenwoods Lake R. R. and Newark branch of Erie R. R. Contract for superstructure was let to American Bridge Co.

Wildwood, N. J.—Paving, Sewers.—Geo. W. Banks, Seacrest Hotel, at $36,000, for macadamizing several streets; Contractor Bennett, at $12,000 for constructing sewers.

Omaha, Neb.—Sewer.—Jens Jensen, at $123,000, for constructing the Izard St. sewer.

Rochester, N. Y.—Sewers.—H. N. Cowles, 6 Gorsline St., at $83,430, for system of sanitary and storm sewers in 12th and 21st wards.

Syracuse, N. Y.—Building.—Contracts for constructing Salina School have been let as follows: W. H. Gough, electric wiring; Joss Brothers, painting; John Burchell & Son, mason work; John R. Walsh, plumbing; John W. Gee, carpenter work contracts, aggregate $83,000.

Solvay, N. Y.—Substation.—H. Wales Lines Co., Meridian, Conn., for substation for Syracuse Lighting Co.

Akron, O.—Sewer.—E. M. McShaffrey & Son, at $1,518, for storm sewer.

Dayton, O.—Sewers.—Contracts reported let as follows: Sewers in District No. 4, Shafer & Dill, at $13,260; sewers in Findlay and other streets, Backus Construction Co., Reibold Bldg., at $2,813.

Hamilton, O.—Bridge.—Central States Bridge Co., Indianapolis, Ind., at $5,292 for Two Mile bridge.

Hamilton, O.—Sewer.—W. H. Louthan, at $2,636

West Point, O.—Piping.—Becker & Seidel Co., at $10,000, for steam and water piping for new power station of Youngstown & Ohio River R. R.

Harrisburg, Pa.—Bridges.—Penn Bridge Co., Beaver Falls, Pa., at $8,389, for bridge over Nescopec Creek, Luzerne County; York Bridge Co., York, Pa., at $54,945, for bridge over Susquehanna River at Jersey Shore.

Harrisburg, Pa.—Paving.—Warner-Quinlan Asphalt Co., at $1.93, for 3,800 sq. yds. of paving.

Lancaster, Pa.—Bridge.—Ferro-Concrete Co., at $3,495, for bridge over Hammer Creek.

McKeesport, Pa.—Sewers.—Henry Bolar for sewer in Beech St.; Hohman & Caldwell for sewer in Sheridan St.

McKees Rocks, Pa.—Bridge Work.—American Bridge Co., at $30,000, for superstructure of 2-track bridge over Chartiers Creek for Pittsburg & Lake Erie R. R.

Philadelphia, Pa. — Paving. — Contracts amounting to about $1,000,000 were awarded Oct. 10. Cunningham & Murray, 1315 Arch St., and the Mack Paving Co., will pave about 10 miles of street with vitrified brick. The same concerns will also lay about five miles of granite block pavement. Contracts amounting to about $500,000 for asphalt paving were let to the Filbert Paving Co.

Wilkesbarre, Pa.—Theater.—Engineering-Contracting Co., Baltimore, Md., for new theater at this place.

York, Pa.—Trolley Road.—York Construction Co., York, Pa., at about $247,000, for construction and equipment of road for Sunbury & Selmsgrove Electric Ry. Co.

Waco, Tex.—Bridges.—The Texas Central R. R., has placed contract for two through plate girder bridges with the Southwestern Bridge Co., Joplin, Mo.

Milwaukee, Wis.—Paving.—Barber Asphalt Co., for paving National Ave.

PROJECTED WORK.

Railroads.

Items Arranged Alphabetically by States.

Denver, Col.—Surveys are now under way from Texahoma, Okla., southeast, for the projected line of the Denver & Gulf R. R. Surveys have already been completed from La Junta, Colo., to Texahoma, 160 miles, and it is stated that contracts will be let soon for the construction of this portion of the line. As projected the total length of the road will be 600 miles. R. E. Davis, Texahoma, Okla., is President.

Eunice, La.—The Eunice, Lafayette & Abbeville Ry. Co., is to be organized for the purpose of building a road from this place. James J. Lewis is interested.

Baltimore, Md.—Baltimore & Ohio R. R. Co., is reported to have received bids on Oct. 10, for constructing the Washington & Western Maryland R. R., which is to be, a spur track into Georgetown, D. C., to serve as a freight line for that end of Washington. The charter and rights of this road were acquired several years ago by the B. & O., but since that time only sufficient work has been done to hold the charter. All of the surveys have been made and part of the grading done. Although bids for the work have been received as stated above, press reports state that the B. & O. has by no means determined to build the road at this time. D. D. Carothers, Baltimore, Md., is Chief Engineer, B. & O. R. R.

Boston, Mass.—Favorable action has been taken by the stockholders of the Boston & Maine R. R., looking to the issue of $6,000,000 of bonds. A portion of this issue will be used for improvements. H. Bissell, Boston, Mass., is Chief Engineer.

Mankato, Minn.—Advices from this place state that the Chicago, Milwaukee & St. Paul Ry., has acquired right of way near Granite Falls for a projected line from Mankato to that city.

St. Louis, Mo.—Carondelet & Webster Ry. Co., of this place, capitalized at $200,000, has been chartered and proposes to construct a railway line from St. Louis to Webster Groves, eight miles. W. E. Winner, J. G. Hayes and H. G. Post are interested.

Seneca Falls, N. Y.—Lehigh Valley R. R. Co., has under consideration an extension of its line from this place to Auburn and perhaps to Syracuse. Matter was informally discussed recently before City Council by officials of the road, among whom were Walter G. Berg, New York, Chief Engineer.

Oklahoma City, Okla.—The Kansas Gulf Port Short Line Ry. Co., recently incorporated at Guthrie, Okla., proposes to construct a line 1,500 miles long, the general plan being to have the road run from Kansas City through Kansas, Oklahoma and into Texas. The capital stock named in the incorporation papers is $36,000.000. The incorporators are J. P. Byrne and Louis E. Potts of Oklahoma City, Okla., Fred A. Jerian of La Junta, Colo., Charles F. Bridges and Thomas Ragsdale of Topeka, Kan.

Guymon, Okla.—Guymon & Southwestern R. R. Co., capitalized at $5,000,000, with headquarters at this place, has been chartered to build a line from Guymon east through Beaver county to Englewood, Kas., or some other connecting point with the Santa Fe in Kansas, and to run west from Guymon through Beaver county to a connection with the Santa Fe in New Mexico. The incorporators are: Jonathan Whitehurst of New York, J. W. Harris J. G. McLarty, E. C. Langston, J. H. Wright, J. W. Rumage, L. E. Latham, J. L. Eddins, T. O. James, W. C .Crow, all of Guymon.

Guthrie, Okla.—St. Louis, Bartlesville & Pacific Ry., has been granted permission to extend its line from Pond Creek, Okla., the present western terminus, to Woods county to connect with the Kansas City, Mexico & Orient; the survey will be started immediately, it is said.

Lorain, O.—It is now stated that the Pittsburg & Lake Erie R. R. will be extended from Youngstown to Lorain, instead of to Cleveland, as was originally intended. J. A. Atwood, Pittsburg, Pa., is Chief Engineer.

Amarillo, Tex.—Engineers are reported to be in the field making the final surveys for the extension of the Choctaw, Oklahoma & Gulf Ry., to Denver through northwest New Mexico and Trinidad, Colo. The extension from Amarillo to Tecumcari, N. Mex., will be completed this year it is said. The distance is 110 miles.

Austin, Tex.—Gulf, Colorado & Santa Fe Ry., has presented to the Attorney General for his approval an amendment to its charter providing for an extension of the lines of that road from Center to Timpson, to connect with the Texas & Gulf Ry. The line will be 18 miles long. C. F. W. Felt, Galveston, Tex., is Chief Engineer, G. C. & S. Fe Ry.

Salt Lake City, Utah.—Advices from this city state that E. P. Clark, of Los Angeles, Cal., representing W. A. Clark of Montana, has been securing terminal rights in Portland, Ore., for the long projected Clark line from this city to tidewater. Surveys for a route were made some time ago, and as projected the line was to run by way of Winnemucca, Nev., northwesterly to Portland.

Port Angeles, Wash.—Chicago, Milwaukee & St. Paul Ry., is stated to have located definite route for a railroad extending along the Pacific Ocean on the west side of the Olympic Peninsula. Condemnation suit to secure right of way for the road has been started. According to the report the railroad will have the Olympic Peninsula branch completed shortly after its tronscontinental line is in operation. The peninsula line will have its terminals at Tacoma and Port Angeles, according to the plans of the railroad company as indicated in the condemnation suits that have been instituted. A branch line of the Milwaukee will extend from Tacoma to Olympia and Grays Harbor and the Port Angeles extension will be an off-shoot of this branch. D. J. Whittemore, Chicago, Ill., is Chief Engineer.

Belington, W. Va.—Surveys for the Belington end of the Fairmont & Southern R. R., have been completed and surveys are now under way for the Pittsburg end. The road as projected is to connect this place and Pittsburg, and bids for its construction are to be asked shortly, it is said.

Glencoe, W. Va.—Loop & Lookout R. R. Co., recently chartered with $100,000 capital, proposes to build a lumber and coal road from the Keeney's branch of the Chesapeake & Ohio R. R. through Fayette and Greenbrier counties, W. Va., to Glencoe, in the latter county, to develop the timber and coal on 100,000 acres along the route. The line will be about 40 miles long. Location of the line has been made and construction is to begin soon. The incorporators are: T. W. Raine, W. W. Raine, L. R. Preyz, J. M. Raine and S. J. Snyder.

Grafton, W. Va.—Walkersville & Ireland R. R. Co., incorporated a few weeks ago for the purpose of building a lumber road from Walkersville to Marlington, in Pocahontas County, has organized, and the following officers were elected: W. H. Bailey, Grafton, President; Harley Sawyer, Grafton, Vice-President; W. B. Mick, of Ireland, W. Va., Secretary; W. H. Mick of Ireland, W. Va., Treasurer. The headquarters of the company are at Grafton, W. Va.

Electric Railways.

Items Arranged Alphabetically by States.

Selma, Ala.—Construction of electric railway between this place is projected. J. T. Slatter, Secretary Commercial and Industrial Association may be able to give information.

Oakland, Cal.—Southern Pacific Co. plans to make several extensions of electric lines in this city.

San Diego, Cal.—South Park & East Side Ry., E. Bartlett Webster, President, has asked franchises over a number of streets, and special election may be called to vote on the matter.

Canon City, Colo.—Construction work on the Canon City Royal Gorge Electric Ry. is to be resumed at once, according to advices from this city, in order to have the line in operation in this city before the expiration of its franchise on Jan. 26 next. About $75,000 has been already spent and about $350,000 will be required to complete the system. Former Governor J. H. Peabody is interested.

Denver, Colo.—Surveys have been practically completed for an electric interurban line from this place to Greeley. Right of way has been secured, and capital obtained, and grading work will be started shortly. The estimated cost of the road, power plant and equipment is set at $1,000,000. The road will be built by the Interurban Construction Co. E. N. Reaser, President, 406 Kittredge Bldg.; Geo. H. Sethman, 406 Kittredge Bldg., is Engineer.

Macon, Ga.—Controlling interest in Macon Light & Railway Co., is reported to have been secured by W. J. Massee, Macon. Extension of street car line is projected.

Clinton, Ia.—Surveys are under way for an interurban line between this place and Cascade via Maquoketa. This place has raised funds for a preliminary survey. Thos. J. Wilcox is promoting the project.

Fort Dodge, Ia.—Advices from this place quote General Manager Blake of the Fort Dodge, Des Moines & Southern, as stating that the electric line would be built into the town of Lehigh, 15 miles south of this place, the coming year.

Oelwein, Ia.—The Turkey River Power & Improvement Co. has secured options on three water powers on Turkey River, and in connection with its power plants proposes to construct an electric railway between this place and Elkader. John Jamison, Oelwein, is interested.

Centralia, Ill.—Arrangements are being made to extend local electric railway to Junction City mine site, 2 miles north of present terminus. A franchise has also been secured for a further extension to Sandoval the coming year.

St. Charles, Ill.—City Coupcil is considering granting a street car franchise to J. T. W. Rudesill, of East St. Louis, Ill.

Indianapolis, Ind.—Grand Central Traction Co., N. P. Carter, Treasurer, which proposes to construct an electric line from Indianapolis to Evansville, has applied to Board Public Works for two franchises in this city. A branch line from Bloomington to Terre Haute is also proposed.

Newport, Ind.—Right of way is being secured for an interurban line from Danville, Ill., to Terre Haute, passing through the towns of Perryville, Cayuga, Newport, Hillsdale and Clinton. Mass meeting was held here recently to further the project, and B. S. Aikman, Newport, was elected permanent Secretary of the committee.

Crookston, Minn.—City Council has granted franchise for street railway to W. A. Marin.

St. Joseph, Mo.—Missouri Valley Traction Co., capitalized at $6,000, has filed articles of incorporation. Company proposes to construct trolley line from St. Joseph to Excelsior Springs and to Mirabile. Geo. Kidd, Excelsior Springs, Mo., and T. B. Campbell, St. Joseph, are interested.

St. Louis, Mo.—Work is stated to have been started on the construction of the St. Louis, Montessano & Southeastern R. R. As projected the electric line is to run from St. Louis to Flat River, 65 miles. Chas. W. Gutke, 5727 Von Versen Ave., St. Louis, is President.

Fargo, N. Dak.—Surveys are reported to have been started at Moorhead, Minn., for projected line of the Northwestern Interurban Ry. Co. Thomas P. Robb is President. E. J. Henriquis, Sioux City, Ia., is in charge of surveys.

Atlantic City, N. J.—Advices from this city state that Wm. J. Thompson, Gloucester, N. J., is promoting a project for the construction of an electric railway from Gloucester to Pleasantville, and across the meadows to this city.

Brooklyn, N. Y.—Franchises have been asked by three trolley companies for about 60 miles of trolley extensions in Queens Borough. The three companies are the New York & Queens County Ry. Co., W. Slater, Chief Engineer, New York; Brooklyn Heights Ry. Co., of Brooklyn, and the proposed South Shore Traction Co.

Cincinnati, O.—Wm. A. Bradford, Pittsburg, Pa., has completed surveys for proposed route of Cincinnati, Reading & Middletown Street Ry. Co., which will construct 35 miles of road from Middletown and Franklin to Bond Hill and Norwood. The estimated cost of the road is $875,000. Guy W. Mallon, Cincinnati, Joseph Brinkman, Reading, O., and G. A. Anderson, Monroe, O., are directors.

Connellsville, Pa.—West Penn Rys. Co., W. E. Moore, General Manager, Pittsburg, Pa., has secured right of way for a new line between Hunker and Scott Haven, connecting with West Newton.

Monongahela, Pa.—Council has granted franchise to Monongahela & Carroll Street Ry. Co., which proposes to build a street car line up Pigeon Creek and on to Bentleyville, Ellsworth and Washington.

Johnstown, Pa.—Local reports state that Rockwood & Bakersville Electric Ry. Co., of which John C. McSpadden, a contractor of Rockwood, is President, has had surveys of its route completed and will have grading work commenced at once.

Edgefield, S. C.—J. C. Sheppard, of this place, is reported to be promoting a project for construction of electric line to connect this place with Augusta, Ga.

Greenville, Tex.—Citizens of Bonham, Wolfe City and Greenville, have formed an organization with J. Riley Green, of Greenville, as Secretary, to take steps to secure construction of an interurban line between the above cities, and also local street car lines.

Electric and Gas Plants.

Items Arranged Alphabetically by States.

Jackson, Ala.—Jackson Light & Power Co. has been organized here and proposes to establish electric plant. Capital stock $16,000. and C. H. Warren, C. E. Mathis and W. F. Monk are interested.

Eureka Springs, Ark.—Syndicate headed by George Sengel and Geo. Tiller, Fort Smith, Ark., have secured control of Citizens' Electric Co. Improvements involving expenditure of $500,000 will be made, it is said.

San Jose, Cal.—Council has adopted preliminary resolution for securing municipal light and power plant.

Lake City, Fla.—J. D. Callaway is organizing company to build water power electrical plant.

Orofino, Idaho.—Electric plant and water works may be established here by F. G. Lynch.

Chicago, Ill.—The Chicago Heat, Power & Refrigeration Co. is being organized by Fred W. Blocki, William F. Brennan, Jeremiah P. Bartholew, James Early and others.

Manito, Ill.—John F. Gay and Thomas Smith of Manito are arranging to install an electric light plant here.

Farmersburg, Ind.—The Tarr Electric Co. recently incorporated with $20,000 capital stock, will ask for bids for the construction and equipment of an electric light plant in Farmersburg, as soon as plans can be completed. A. D. Tarr, W. S. Balridge, and E. W. Jennings are interested.

Indiana Harbor, Ind.—The Indiana Harbor & East Chicago Electric Co., has been incorpotated to construct and equip a plant to supply the city and other nearby towns and cities with light, heat and power. H. H. Phillips, R. M. Cole and H. S. Oakley and C. B. Woods are interested.

Manchester, Kans.—E. A. Watkins has arranged to install an electric light plant here.

Escanaba, Mich.—The Escanaba Electric Power & Pulp Co., capitalized at $500,000, has been granted the right by the city of Escanaba to furnish the city plant with power for lighting the streets and commercial light and power. J. M. Malloy, of Watertown, Wis., P. L. Utley, of Watertown are interested.

Manchester, Mich.—Special election was held Oct 14 to vote on purchase by village of local electric light plant.

Wyandotte, Mich.—City will expend $20,000 for extension of electric light plant.

Cambridge, Mass.—Cambridge Electric Light Co. is seeking to increase its capital stock $100,000.

Aurora, Mo.—The Aurora Light, Power & Refrigerating Co. has been incorporated with a capital stock of $50,000 by J. M. Hawkins, C. K Gimlerling, Mrs. E. J. Martin and others.

Valley City, N. Dak.—City electric light plant is to be enlarged.

Troy, N. Y.—Schaghticoke Electric Co., has asked permission to construct transmission lines from its projected plants to Schenectady. Company proposes to construct dams at Hoosick River at Schaghticoke and Johnsonville to develop 20,000 H.-P. Geo. E. Green, Hoosick Falls, N. Y., is President.

Elizabethtown, Pa.—Marietta & Elizabethtown Gas Co., capitalized at $5,000, has been incorporated. H. P. Smith, Lancaster, Pa., is interested.

Ashland, Pa.—Ashland Gas Co. has asked charter to operate in Clarion and Venango Counties.

Mill Creek, Pa.—Mill Creek Electric Co., capitalized at $5,000, has been incorporated. Wm. P. Woods, Lewistown, Pa., is interested.

Mount Union, Pa.—Mount Union Light & Power Co. has been incorporated. Capital stock is $25,000 and John L. Dickson is interested.

Pittsburg, Pa.—Manufacturers Fuel Gas Co., Pittsburg, is seeking state charter.

Sewers.

Items Arranged Alphabetically by States.

San Francisco, Cal.—Ingleside Improvement Club has appointed committe, A. B. Clark, chairman, to take steps toward securing sewer system for Ingleside.

Monterey, Cal.—City Engineer is to prepare map of proposed sewer system for Monterey Heights.

Holly, Colo.—Town is to have sewer system constructed at a cost of about $25,000.

Essex, Conn.—Sewer district may be formed here.

Brazil, Ind.—Final surveys are nearly completed for sewer system for this place. Geo. A. Fletcher is City Engineer.

Indianapolis, Ind.—Plans are being made by Charles A. Brown, Assistant City Engineer, for sewer to replace present sewer in Fulton St., between Ohio and St. Clair St. Sewer will be 1½ miles long and will cost about $10,000.

Baltimore, Md.—Sewerage Commission has asked for $2,515,000 for new work for next year.

Bath, Me.—City will probably secure engineer to make plans and supervise construction of sewer system.

Ishpeming, Mich.—Board Public Works is preparing general plan for construction of complete sewer system for the 6th ward.

St. Louis, Mo.—Sewer Commissioner Fardwell has prepared tentative plans for the abolishment of the River Des Peres within the city limits by sewer construction. According to the tentative plans the sewer would cost about $4,000,000.

Plainfield, N. J.—Residents of North Plainfield will probably vote Nov. 5, on matter of sewering that borough. George F. Brown is member of committee.

Rahway, N. J.—State Sewerage Commission has granted this city four years in which to change its sewer system to prevent pollution of Rahway River. The work will cost about $100,000. Dr. A. J. Westlake is Mayor.

Binghamton, N. Y.—Reconstruction of trunk sewers of this city is under consideration.

Chester, O.—Chester Sanitary Sewer Co., capitalized at $10,000, has applied for a charter. O. O. Allison and Joseph N. Finley are interested.

Archbald, Pa.—Several sewers are to be constructed.

Chester, Pa.—Construction of sewer for Norwood Borough is proposed.

Bristol, R. I.—Election was held Oct. 21 to vote on appropriating additional $3,000 for building sewer in the Main road.

Woonsocket, R. I.—Council has been asked to build sewer in Social St., from present terminus to the state line.

Rock Hill, S. C.—Committee, W. J. Roddy, chairman, is advocating construction of sewer system to cost about $117,000.

Seattle, Wash.—James Black Masonry & Construction Co., was only bidder Oct. 12, for the construction of the Green Lake sewer. The bid was $993,036. City Engineer's estimate for the work was $750,000.

Mannington, W. Va.—City will lay new sewer from Burttown Hill to the creek.

Preston, Ont.—Town Engineer has completed plans for sewer construction for this place.

Water Supply.

Items Arranged Alphabetically by States.

Grand Junction, Colo.—Bond issue may be voted for new water system.

Albany, Ga.—City will expend $7,500 for water main extensions.

Blackshear, Ga.—Installing of water works, sewers and electric lights is under consideration.

Joliet, Ill.—New water mains are to be installed in a number of streets.

Moline, Ill.—The city of East Moline will build a stand pipe reservoir and pumping station.

Birmingham, Ala. — Municipal Ownership League is agitating for special election to vote on issuing $3,000,000 of bonds for building water works plant.

Caledonia, Minn.—This place has voted to issue $6,000 of bonds for enlarging water and electric light plant.

Meridian, Miss.—A $50,000 bond issue for improving municipal water works has been voted.

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U. S. ENGINEER OFFICE, Portland, Oreg., Oct. 18, 1907. Sealed proposals for furnishing and delivering four hoisting engines, three locomotives and two boilers will be received here until 11 a. m., Nov. 18, 1907, and then publicly opened. Information furnished on application. S. W. ROESSLER, Lt. Col., Engrs. 17-4t

---

TRUNK SEWER AND TUNNEL.

White Plains, N. Y., Oct. 10, 1907.
Office of the Commission, No. 2 Grand St.

Pursuant to the provisions of Chapter 646 of the Laws of New York, 1905, as amended by Chapter 747 of the Laws of 1907.

SEALED BIDS, addressed to the Chairman of the Bronx Valley Sewer Commission and accompanied by a certified check for at least five per cent of the amount of security required for the faithful performance of the contract for each section bid upon, will be received up to November 7, 1907, at one-thirty P. M., for furnishing all the work and materials necessary for the watertight and enduring

CONSTRUCTION of each one of the seven sections which together comprise about twelve miles of circular sewer from three and one-third to six feet in diameter and about three miles of circular lined tunnel mostly six and one-half feet and eight and one-half feet in diameter. The material to be either monolithic reinforced concrete, reinforced concrete blocks or brick masonry.

PLANS and specifications may be seen at the office of the Commission. The Invitation to Contractors, the Form for Bids, the Specifications and the Form of Contract and Bond may be obtained from the Secretary of the Commission upon the payment of one dollar, to be repaid when the same are properly used in bidding.

FORM OF BID must fulfill the requirements of the Invitation and be made out upon the printed Form of Bid as above obtained and the Commission reserves to itself the right to reject any or all bids or to accept that one or those whose acceptance will, in its judgment, best secure the public interest and the efficient performance of the work mentioned.

FRANK N. GLOVER,
Secretary.

Office of the Commission, No. 2 Grand St.,
White Plains, N. Y., October 10, 1907.
17-2t

PROPOSALS FOR WATER PIPE.

Office of the Superintendent of the Water Department of the City of Phoenix, Ariz., September 25, 1907.

Separate bids will be received by the Superintendent of the Water Works of the City of Phoenix, Arizona, at the office of the said Superintendent, up until 3:30 p. m., of December 1, 1907, for the following:

1. Furnishing all material and labor for the completion of contemplated improvements.
2. Supplying material only.
3. Necessary work for the installation of the same.

Specifications can be obtained, upon application, from the Superintendent, at City Hall, Phoenix, Arizona.

A certified check for five per cent of the amount of the bid, made payable to Frank Thomas, Recorder for the City of Phoenix, is to accompany each proposal, to be held as a guarantee that a contract with bond approved by him will be entered into by the party whose bid is accepted, in accordance with the terms of the said bid.

The Superintendent reserves the right to reject any or all bids, in whole or in part.

ROBT. CRAIG,
16-3t Superintendent.

PUBLIC ROADS.

Concord, N. C.

The Board of Commissioners for the County of Cabarrus will receive sealed bids up to noon, October 24th, 1907, at Concord, N. C., for grading and macadamizing about ten miles of public road from Concord to Kannapolis, also about one mile on Concord and Charlotte road. Plans and specifications may be seen at the office of Quint E. Smith, Civil Engineer, Concord, N. C.

16-2t JOHN A. CLINE,
Chairman County Commissioners.

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WANTED—Position. A well known chief engineer, 50 years of age; having had 30 years' experience on location, construction, and other railway work, is looking for change. Is especially well fitted to investigate projects and prepare estimates for investors. Address "W. P.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

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WANTED—Complete information covering electrical power transmission using water power; also data concerning conveyors for carrying material in tunnel excavation, together with machinery for operating same. J. H. Devereux, Chilcoot, Calif.

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CIVIL ENGINEER—Southern Illinois, to act as assistant to resident engineer on railroad construction; $85 per month to start; must have sufficient experience to work independently. W 8338, The Engineering Agency, Inc., Chicago.

WANTED—Railroad Engineer Maintenance of Way—South. Man familiar both practically and theoretically with steel work, sufficent to figure and check trusses, bridges, engine loading, etc., and also inspect steel work. Also familiar with track work. $100 and expenses away from headquarters. W 8008, Engineering Agency, Chicago.

YOUNG ENGINEER MINNESOTA—Field work as instrumentman, calculations on earth work and plotting of notes in the office. Good man needed quickly; about $90. W 8295, Engineering Agency, Chicago.

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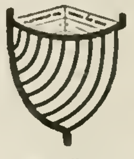
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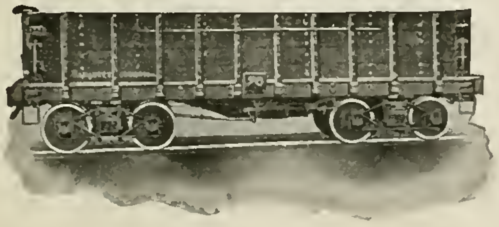

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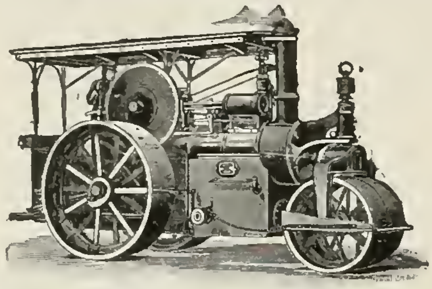

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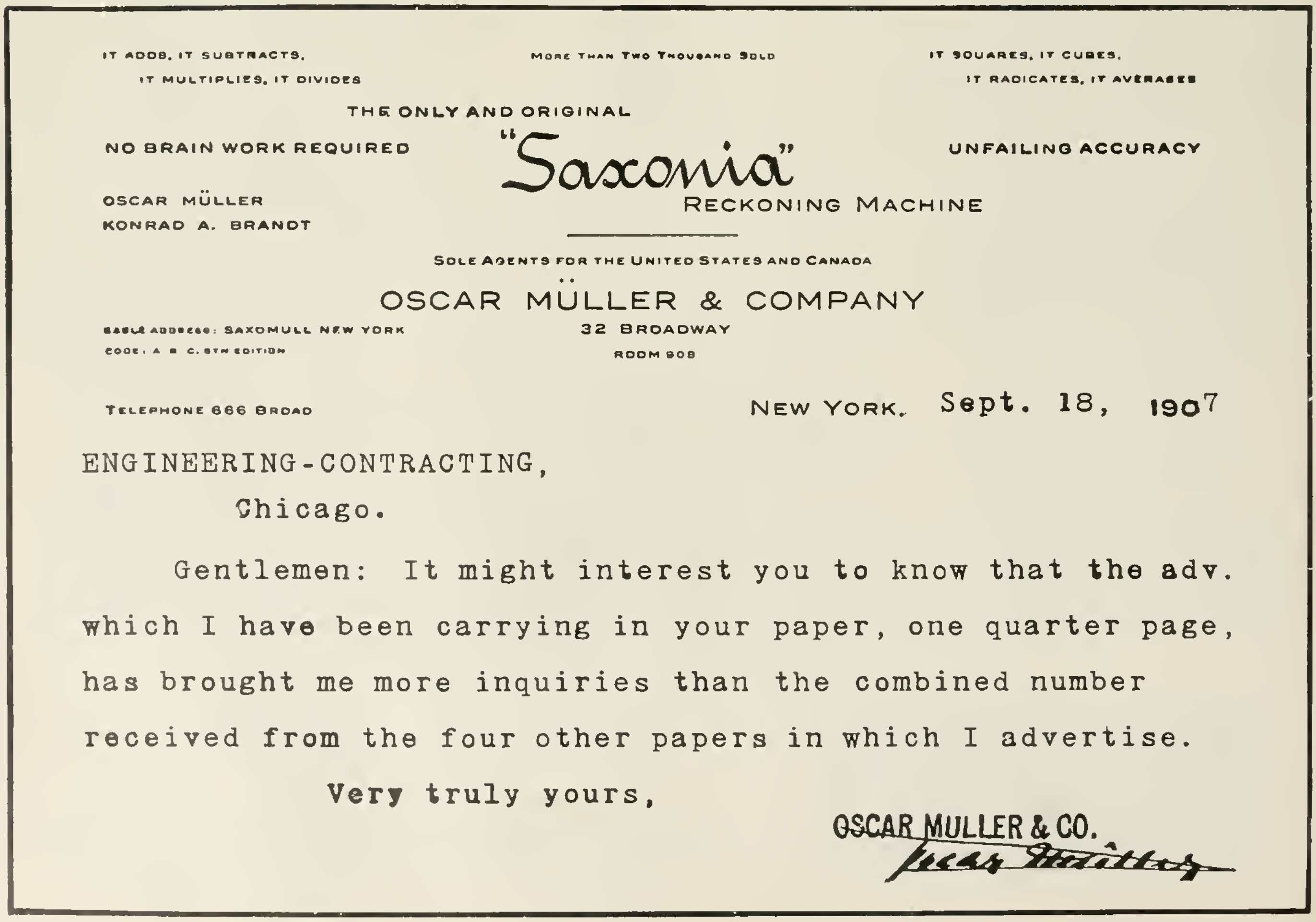

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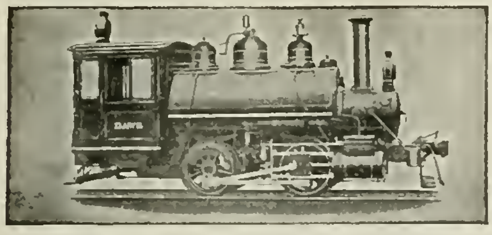

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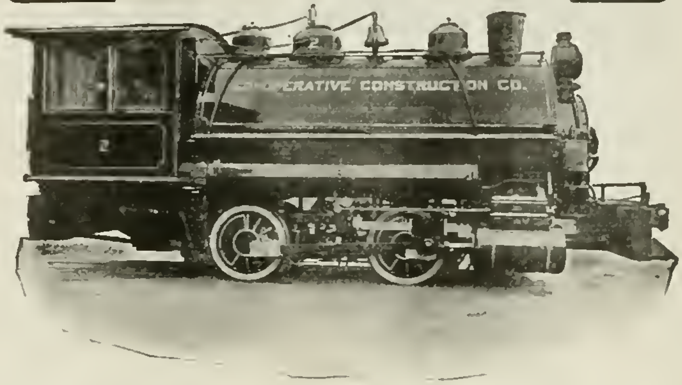

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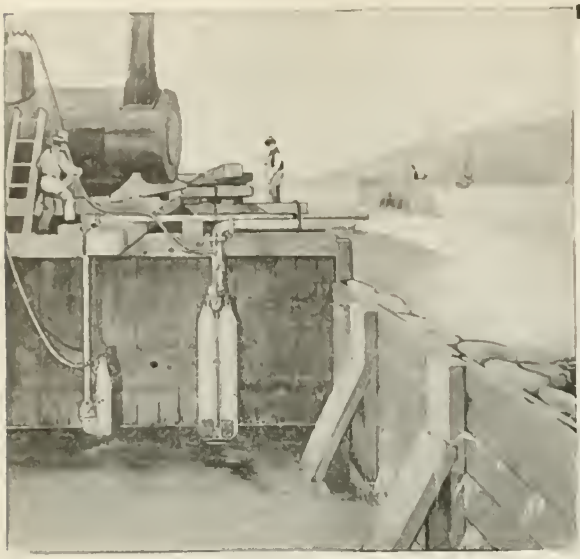

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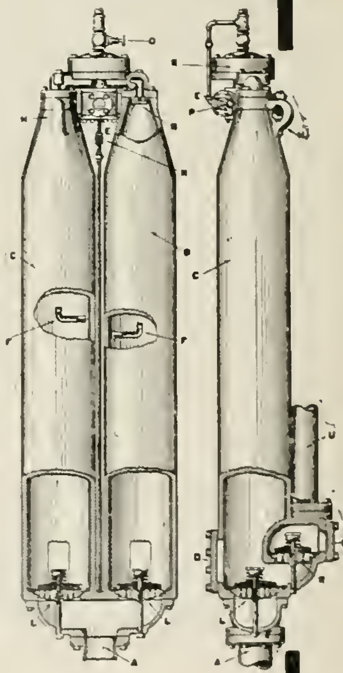

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The Surface Finish of Concrete Structures.

The minds of engineers are slowly but surely being weaned of the notion that nicety of form construction is the secret of handsome surface finish in concrete work. It is probably premature to say that the time is here when the contractor demands of the form work only that it shall give him the rough cast of his finished wall face, but we may venture to assert that such a time is very near. It is not practicable to secure a pleasing surface finish on concrete from the forms alone and the sooner builders give over doing cabinet work in the attempt the sooner we shall have concrete work taking the rank that it is capable of assuming as a sightly building material.

The molded concrete surface as it comes from the molds is not pleasing. We except from this charge only sand molded work and certain special face mixtures of which we shall speak later. Concrete from wooden molds shows the joint marks and the grain marks of the wood and concrete from metal molds has a lifeless color that is even more objectionable than board welts and grain marks. Sand paper and putty and oil cannot make board molded concrete pleasing; it is truer art to acknowledge the medium of the mold and frankly display the welts and roughness produced by the boards—indeed there are some who regard this as the truest art and we are not sure that they are not right. However, taste is agreed generally that the most pleasing surface finish is that which conceals the medium of the mold and it is in conformity with this taste that we shall argue.

No perfection of form construction that is practicable in ordinary work will conceal the evidence of the forms on the molded concrete. This is true not alone of wooden molds; it is universally true of metal molds. The evidence of the metal in the lifeless lustre of the surface is quite as plain as is the evidence of the wood in the joint and grain marks. This means one of two things: either we must put up with the evidence of the molds or we must recognize the purpose of the molds as being merely the production of the rough cast surface which is to be treated by a separate finishing process to complete the work. There can be little doubt in which direction popular choice will leap.

There are now three processes by which concrete surfaces can be finished and get generally pleasing results. One is to strip the molds while the concrete is still green and soft and scrub the cement away with brushes and water until the sand and stone are exposed. Another is similarly to lay bare the sand and stone by etching the surface cement away by means of an acid wash. The third is to hammer-dress or grind or otherwise tool the concrete surface as we dress natural stones. It is not the purpose of these remarks to advocate one or the other of these methods—they have all been described in past issues of this journal and having seen many examples of each we can vouch that each and all of them give satisfactory results.

So far, we believe that none of these methods of finishing concrete has been applied, except possibly in an experimental way, to machine molded building blocks. The query, why? naturally arises. It cannot be for the reason that the ordinary concrete building block has a pleasing finish, for it has not. We are assured in making this assertion that block makers will deny it, but, let us ask, are building block makers getting the approval of architects for their product in competition with cut stone for really fine work? We know of cases in which they have and we also know that in each and every one of these cases the architect has modified the usual commercial product to suit his requirements. We do not say this in depreciation of the concrete block as a building material, but we do say it in depreciation of the neglect generally—not always—of block makers to make the most of their opportunities.

Returning to our main thought: what is to prevent the several methods of finishing concrete surfaces that we cited above being applied to concrete building blocks? Nothing, it would seem, but the expense. What is this likely to be? Tooling may be as expensive as we like to make it. Fairly good bush hammer work can be got at 5 cts. per sq. ft., if pneumatic tools and common labor are employed and we have known it to cost 25 cts. per sq. ft. when done by hand and by stone cutters at $4 per 8-hour day. At 5 cts. per sq. ft. it adds 4½ cts. to the cost of an 8x16-in. block to bush hammer one face. In the matter of tooling blocks, however, it is not so much the securing of a rough tooled surface that is wanted as it is to cut away the dull and lifeless surface skin, and where is the difficulty of doing this by grinding? Though we do not now recall where, we believe that this method has been tried and, using coarse carborundum wheels, as we recall it, with fair success. A portable grinder which one man could manipulate by carrying it from block to block like a pneumatic tool should not be difficult to devise and in fact such like tools are now on the market which would very likely serve the purpose.

In the matter of applying the scrubbing or the acid wash processes to building blocks, there should be even less difficulty. Either method is within the limitations of common labor to handle satisfactorily and at a cost, we should imagine, not to exceed over two cents per block.

In conclusion we may note that two methods of molding concrete without subsequent finish have come to general and favorable notice. One method is to pour a nearly liquid mixture into sand molds and the other is to tamp an exceedingly dry mixture into wooden forms. The first method is limited practically to block work, but the second is capable of being used for mass concrete work of any size and character. The most extensive and successful use of the second method that we have seen has been in the concrete buildings, bridges, etc., for the Chicago, Ill., park systems. With ordinarily good form work these structures show an even, coarse grained surface with absolutely no evidence of grain marks and singularly free from joint marks.

The consummation of satisfactory concrete surface finishes lies, to our way of thinking, in getting entirely away from the idea that they are a result of nicety in form construction. Once we accept the idea that the sole purpose of the forming so far as surface finish is concerned is to give us the rough cast surface on which to work we shall have solved most of our troubles as to the surface finish of our concrete work.

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Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Method and Cost of Building a Reinforced Concrete Garage

The reinforced concrete garage to be described in this article has, in its design, several interesting features. The architects for the structure were Watson and Huckel, of Philadelphia, while the contractor for the reinforced concrete was the Turnbull Construction Co., Philadelphia, Pa. The system of reinforcing used was the Monier modified. We are indebted to Mr. Reygondeau De Gratresse, Assoc. M. Am. Soc. C. E., vice president of the construction company, for the information from which this article is compiled.

General Descriptiton—The garage was built in Philadelphia. It is rectangular in shape, being 53 ft. wide and 200 ft. long. It was made four stories high, but the columns and footings were designed for six stories, to admit of two additional floors being added, if needed in the future. The lot built upon was the same size as the building, hence, as the footings of the side columns could not project beyond the property line, the columns and footings were designed as shown by Fig. 1, thus giving a cantilever, which is somewhat unusual in reinforced concrete buildings. The design of these footings and columns in connection with the large girders they support is of peculiar interest to concrete engineers.

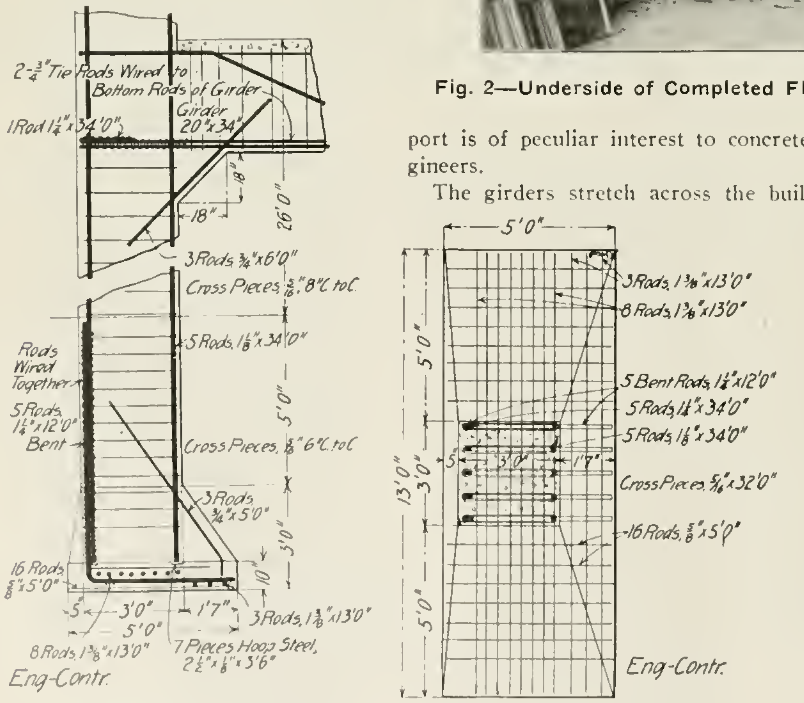


Fig. 1—Details of Column and of Cantilever Column Footing.

The girders stretch across the building, being 53 ft. long, and are 20 ins. wide and 34 ins. deep; Fig. 2 shows these girders completed. Figure 3 shows forms and reinforcing ready for one of these large girders. The steel being assembled and swung from beams supported by trestles over the forms and at the proper time let down into place as a unit.

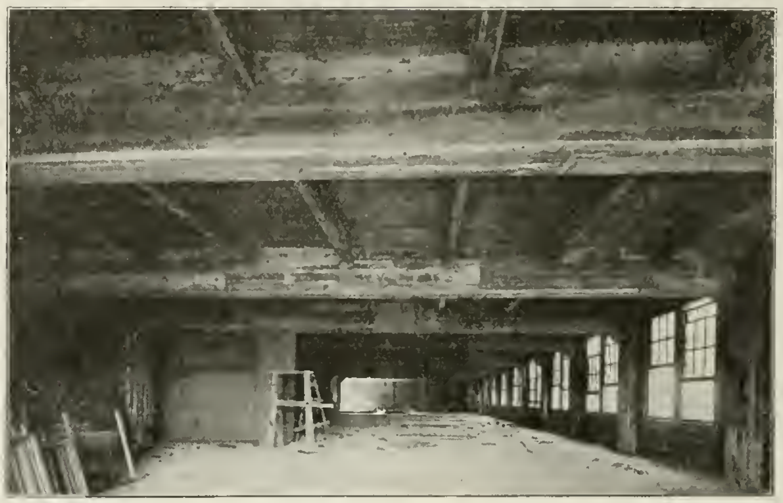


Fig. 2—Underside of Completed Floor Showing Girder and Beam Arrangement.

On the mezzanine floor were two 18 ft. cantilever girders, shown by Fig. 4, which also illustrates the graphic calculations made for their design. The side and back walls of the building are of brick, while the front is of ornamental stone. The cost of these walls is not included in the cost of the work given.

The floors were of concrete as well as the roof, all the floors being finished in a 1-in. granolithic wearing surface.

Progress of Work—The system used by the contractors compelled quick and efficient work. The entire concrete structure was erected in three months from the time the excavation was started for the building. The excavation work took nearly 50 days to complete. As much as 140 cu. yds. of concrete were put in place in a day after the forms had been erected.

Quantities of Work—The total number of cubic yards of concrete in the building, including the stairs (which were of concrete) and the floor resting on the ground (not reinforced), footings, columns and four reinforced concrete floors was about 1,910 cu. yds., distributed as follows:

	Cu. Yds.
Footings	190
Columns	450
Floors and roof	1 100
Floor on ground	170
Total	1,910

There were used on the job 237 tons of reinforcing steel. The amount in each class of work and the pounds of steel per cu. yd. were as follows.

	Tons Steel.	Lbs. Per Cu. Yd.
Footings	42	442
Columns	20	90
Floors and roof, including girders	175	318
Total	237	272

This is equivalent to 2 per cent of steel, in 1,740 cu. yds. of concrete, not including the 170 cu. yds. of floor on the ground which was not reinforced.

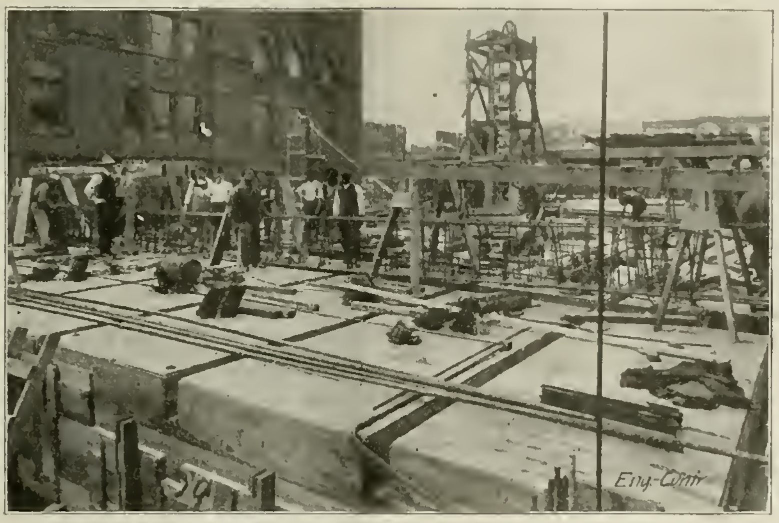


Fig. 3—Floor Forms and Method of Placing Reinforcement.

Forms—Forms had to be used on all the concrete except the ground floor. The area of the 1,740 cu. yds. of concrete covered by forms was:

	Sq.Ft.
Footings	4,000
Columns	20,000
Floors and girders	70,000
Total	94,000

For the work 170,000 ft. B. M. of new lumber was bought and 50,000 ft. B. M. of old lumber was used, the cost being:

50,000 ft. B. M. at $13	$ 650
170,000 ft. B. M. at $26	4,420
220,000 ft. B. M. at $23	$5,070

Since 220,000 ft. B. M. were used for the 1,740 cu. yds., there were 126 ft. B. M. per cu. yd. of concrete.

New forms were made for each floor, except the sides of the girders, which were used over for each floor, where the sizes would admit of this being done. The props under the girders were allowed to remain in place throughout the building until the entire job was completed. The forms for the roof were made entirely of the material used on the floors below. The area of concrete covered by the new lumber was approximately 80,000 sq. ft. This gives a cost for lumber of 6.4 cts. per square foot.

The forms used for the columns and for the girders and floors are illustrated by Fig. 5. A force of fifteen carpenters working under one foreman framed, erected and tore down all forms. Laborers handled all the lumber for the carpenters except when they were at work mixing and placing concrete. The foreman was paid $35 per week, while the carpenters were paid an average of $4.40 for an 8-hour day. Laborers were paid 17 cts. per hour and worked a 10-hour day. Over the laborers was a foreman who received the same wages as the boss carpenter. The forms for a floor were erected in from 8 to 10 days. For the framing, erecting and tearing down of the forms the labor cost was about $3,480, which gives a cost of $2 per cubic yard. For the carrying and handling of the lumber the cost was about $1,914, which gives a cost of $1.10 per cubic yard. This gives a total cost per cubic yard of forms as follows:

	Per cu. yd.
Lumber, 126 ft. B. M.	$2.90
Framing, erecting and tearing down	2.00
Handling lumber	1.10
Total	$6.00

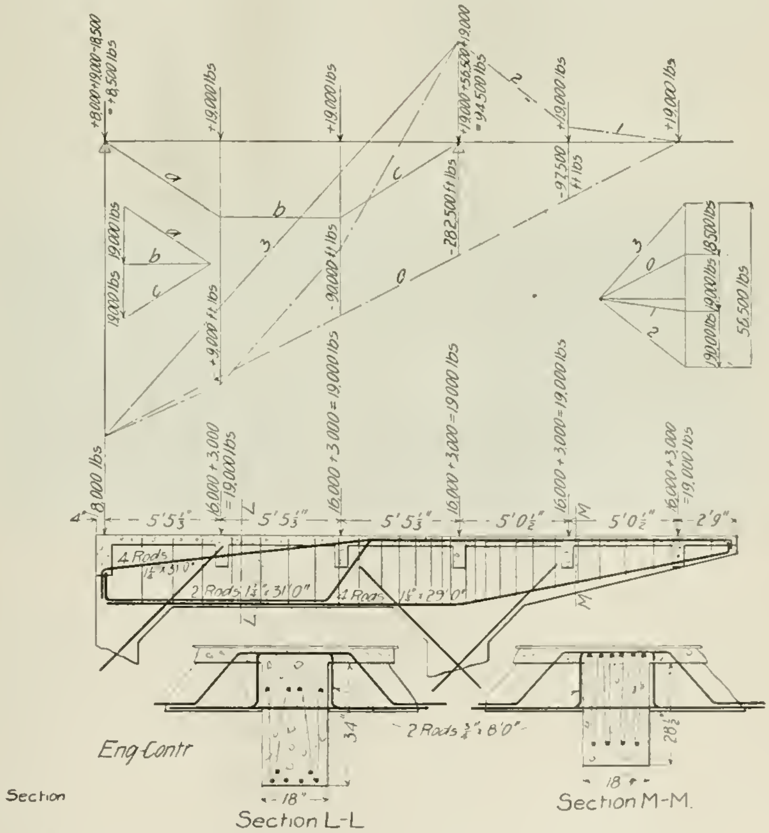


Fig. 4—Details of Cantilever Girders for Mezzanine Floor.

This cost is high, owing to the fact that so little of the lumber was used a second time, there being only from 16 to 20 per cent so used. For the 220,000 ft. B. M. of lumber used on the job the average cost per thousand for the forms was:

	Per M.
Lumber	$23.00
Framing, erecting and tearing down	15.67
Handling lumber	8.70
Total	$47.37

The cost per square foot of concrete for the area covered by forms was:

Lumber	$0.064
Labor	0.057
Total	$0.121

Concrete.—The concrete was mixed by two Chicago improved cube mixers, with special hopper attachment. The concrete was made of ¾-in. trap rock, and Alpha Portland cement was used. The mixers were located on the bottom floor, one in the front and the other in the rear of the building. The materials were delivered close to the mixer and the hoist, operated by a hoisting engine, was close to the discharge side of the mixer. This arrangement allowed of quick and economical work. The forms for a floor being put in place, two days sufficed to mix and place the concrete. The force employed on this work was a foreman and 30 men. Their wages are given under the title of forms.

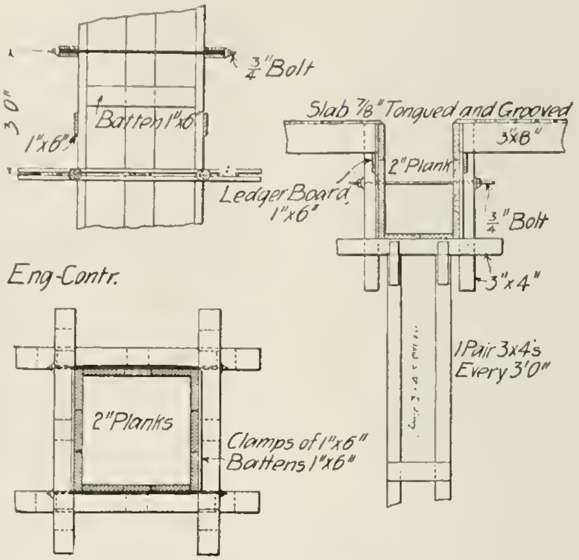


Fig. 5—Details of Column and Floor Forms.

The concrete was mixed wet. One day the columns were put into place and the second day the girders and floor slabs were cast. The labor cost for mixing and placing the concrete was $3.800, or $1.95 per cubic yard. The cost of $1.95 includes the cost of finishing the floors and other exposed surfaces, but not the handling of the steel and placing it. The labor on steel cost $2.05 per cubic yard for making up the units and placing them. This is equivalent to 3/4 ct. per pound. The total cost per cubic yard for lumber and labor was:

Lumber	$2.90
Labor on forms	3.10
Labor on concrete	1.95
Labor on steel	2.05
	$10.00

Fig. 6—View Showing Mezzanine Floor.

It must be remembered that the lumber used in the forms had a salvage value, for which no allowance is made in the above $2.90.

The job was done during good summer weather and sufficient labor was kept on the job to allow of the work being carried on expeditiously.

According to a recent bulletin of the U. S. Geological Survey on the production of glass sand, sand, and gravel in 1906, the most universal use of sand is for building; 14,388,378 tons of this sand, valued at $5,166,532, were reported in 1906, as compared with 10,127,750 tons, valued at $4,284,740, in 1905, an increase of 4,260,628 tons in quantity and of $881,792 in value. This total includes sand for concrete building, all mortar sand, and sand for rough and fine plastering, and the value per ton varies from 25 cts. to $1. New York reports a larger output than any other state —3,369,194 tons, valued at $1,045,844. Pennsylvania, Missouri, Illinois, Indiana, and Ohio come next, in the order named. The greater part of this material is dredged from the sea beaches on Long Island and from the Delaware, Ohio, Tennessess, Mississippi, and Missouri rivers, and is obtained very cheaply.

During the seven year period from 1900 to the end of 1906 the railway mileage of the United States increased from 190,833 to 222,635 miles of road.

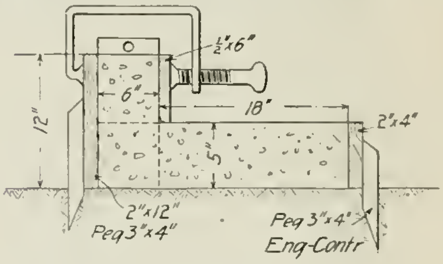
The total lumber production (excluding lath and shingles) in the United States in 1906 was 37,490,067 M. ft. B. M.; in 1905 the production was 30,502,961 M. ft. B. M.

Method of Building a Concrete Curb.

In our issue of July 24, 1907, page 65, a correspondent asked as to the method of building concrete curbs. We have published two articles on this subject, one March 13, 1907, page 116, and April 10, 1907, page 156.

Mr. Stobaugh of the Stobaugh-Burns Construction Co., which has built miles of concrete curbs on Long Island, furnishes us with a description of the method used by his company.

The curb is built in 7-ft. sections. The back form, a 2x12-in. plank, is held in place by pegs as shown in Fig. 1. The entire base and gutter are cast first, the front form being a piece of 2x4 held in place by pegs. After the concrete is put in the forms, sheet iron plates 6x14 ins., 3/8 in. thick, are driven down into the concrete, 7 ft. apart. Against these plates on top of the water table is a 1½x6-in. plank, which is held tightly against the sheet iron plates by the screw clamp shown in Fig. 1. The top part of the curb is then cast.



Form for Concrete Curb and Gutter.

After an hour or two the clamp is removed, and the front board is taken off. Then the sheet iron plate is pulled out by means of a hook through the hole in the top of the plate. The other forms are left in place until the concrete is well set. As soon as the plate is withdrawn, the top and front of the curb and the water table are finished off with a trowel. The space left by the plate is plastered over and this acts as an expansion joint.

By oiling the boards before setting them in the forms each time the same forms can be used over many times. The plates, of course, last indefinitely. We are told that this is an economical method of setting forms for curbs.

A total of 1,481,307 cu. yds. of excavation was done on the Panama Canal during September. This amount was divided up as follows:

	Cu. yds.
Excavation:	
Culebra	753,278
Gatun	123,738
Mindi, Chagres and La Boca	55,814
Dredging:	
Colon division	403,852
La Boca division	144,625
Total	1,481,307

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Engineers' Contracts and Specifications from a Contractor's Point of View.*

BY JAMES W. ROLLINS, JR.†

A contractor must base his figures on definite information, or else make some wild bid, the degree of wildness being in accord with the risks to be run. On some contracts this element of uncertainty must be large, and the writer believes this to be the only class of work properly done on a percentage (or cost plus) basis. But also in very many other contracts there are many uncertainties injected, some dependent on the wording of certain clauses, from which the contractor's only hope of salvation is the fair mindedness of the engineers; and here the man knowing the engineer and his way of handling work has the advantage over the stranger.

For instance, quoting from an existing contract, "Excavations shall be made of dimentions indicated upon the plans, where dimensions are given, *except as otherwise directed.*"

"Piles shall be driven not below elevation 102, and shall be cut off at these levels unless *otherwise directed.*"

In the first case quoted, plans showed excavation to —28, and then comes in the "otherwise directed" clause by which excavation could be made to —50 if desired, at no extra price to contractor.

Under the pile clause they may be cut off anywhere.

Referring to another contract—for a dam —"if excavation is required below a certain grade, a special price is to be paid for such work."

Which of these clauses do you think the most fair, and can you suggest any reason for putting such uncertainties into a contract, without the provision for a just and proper payment for the work done?

The very customary clause in a contract which makes the chief engineer the sole judge of everything, the quality of work, the amount done and the value of it, appears to us to be a most unjust clause and one entirely out of the spirit of mutuality which has been referred to. The need of an arbitrator does not come until parties in interest have disagreed, and then under this clause one of them settles it "for good and all."

On the mutuality basis, the absolute disclaimer of any responsibility for the accuracy of borings seems unjust. Many of our large water jobs give us extensive and detailed plans of borings, and contractors must necessarily base their figures on them. If these borings prove to be wrong, and the contractor suffers thereby, why should not this be borne by the owners? It is not a contingency figured on by the contractor, and in all faith and justice he should not suffer. He has to take chances on the winds and floods, the frosts and the thaws, the acts of God and the perversity of man, of quicksand and other classes of excavation, so why should be added to all these the errors of "borists," and they make many?

Clauses in contracts which in any way give the engineer control over the methods to be used to do the work, or those which throw the responsibility of the work designed by the engineer on to the contractor, are great sources of trouble. This means divided responsibility, and this, as sure as fate, *trouble,* for no two men, especially a contractor and an engineer, can exactly agree upon methods of doing work.

Personally the writer fails to see why any engineer wants to assume the responsibilities of others, and, where his clients are protected by suitable bonds, why he doesn't let the contractor go ahead and make his own plans and work out his own salvation, or damnation, as he will.

A clause from a Boston transit commission contract bears on this subject:

"But neither the commission nor any member of it, nor the engineer, etc., shall have any control or direction over the progress of the work, nor any control or superintendence over the apparatus, ways, works, machinery or plant, the sole responsibility for the proper handling of which, as well as for the safe and proper conduct of the work, resting solely with the *contractor.*"

Inasmuch as this commission's work was done under very expensive buildings and the city streets, where great trouble, loss of property and life were possible, it seems to me that the commission showed its good sense by keeping clear of the "ways and means" and the temporary work, and letting the contractor do the work his own way and assume the responsibility.

Another clause in many contracts, that the engineers may shut down the work at any time and for any reason, and the contractor has no redress. This clause must have had its origin in old railroad construction, where the question of right of way, or of alignment was always uncertain, and it has been perpetuated to-day to our great sorrow and many times our loss. Here again the mutuality comes in: the contract was let in good faith, with no idea of any delays for anything.

To insure the completion "on time," the lawyers—I don't think the engineers ever coined any such expressions—meekly say, "Time is of the essence of this contract, and you shall pay $100 a day, not as a penalty, but as liquidated damages."

Hence the proposition: We must finish on time or pay $100 a day, but the commissioners can hold us up for any length of time and pay us nothing for the loss to us for this delay. We build special plant to do the work, get men trained to do the work properly and well; then comes the order to stop, shut down the plant and discharge the men. The plant cannot be moved, but must stay idle, new men must be trained over again; if work is done on a rising market, if labor demands more pay, we pay it, and all this loss comes on the contractor. Why should it? We didn't figure on it. It is a contingency unseen, and in all justice payments should be made on the *mutual understanding basis.*

Not content with the general obnoxious and unjust conditions mentioned, which are very common in contracts, often special provisions are made, which put most extraordinary powers in the hands of the engineers, and as they are hastily read over by the contractor, do not mean much. For example:

"The said contractors hereby declare and agree that they shall be accountable for the full performance of this contract, and by the signing hereof admit that the said plans, elevations, sections, specifications and parts before referred to are sufficient for their intended purpose of doing the said work, and that the work can be successfully executed in accordance therewith without any additional or extra work other than that set forth thereby or necessarily inferred to be done from the general nature and tendency of the plans, drawings and specifications aforesaid upon a fair and liberal construction thereof."

This innocent clause cost us on one contract $10,000. We took a contract to rebuild two abutments and one pier for a river bridge. The plans, not very complete, showed the new abutments to be about 18 ins. clear behind the old work, which had to remain in place until new work was built. These abutments were 36 ft. high, and when excavation got down to water level it was found that the old work was thicker than the plan showed, and left no room to put in cofferdam between it and the new work. It cost $10,000 to get the lower 4 ft. of these foundations, owing to the inability of making cofferdams tight.

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*Abstract of paper read before the Boston Society of Civil Engineers, published in Journal Association of Engineering Society. Our abstract is about one-fourth of original paper and discussion.

†President, Holbrook, Cabot & Rollins Co., Contractors, Boston, Mass.

It is a general impression among engineers that clauses requiring impossibilities are null and void and that a court would not recognize them, but the law on the case is very deficient and the cases tried in this country very limited.

But these cases put all the burden of unforeseen things on the poor contractor, and when trouble comes, the engineers refer the matter to the lawyers and they interpret the law, not by right or justice, but the strict legal meaning of the contract, and I venture to say that not a single contract is made to-day on large works which does not give the engineer power enough to put the contractor into bankruptcy by such clauses as I have been quoting. All this is unnecessary. Every contract has a provision for extra work and for the filing of all claims for damages, change of plans, etc., with engineer once a month, and the right of engineer to see all papers connected with these claims. They cannot be collected by demand of contractor, but only as last resort by a court of law, which in our free country is the court of last resort to all injured souls. So why should not contracts be made which give the contractor some rights to a settlement other than by the man he cannot agree with, by some disinterested person who can do justice, having some regard to the old principle of man-to-man settlement?

Many contracts to-day show the improvements which we wish to become more general, and eliminate the clause which makes the engineer the final judge of all things, substituting settlement of disputes by arbitration. This is a great step forward, and we trust that the other few clauses which make trouble, when trouble comes, may be eliminated.

The courts now lean towards the "intent" of the parties making the contract, the "mutual understanding," between the contracting parties. This means that the contractor shall do what the plans and specifications call for in a fair and just interpretation and under the conditions which at the time of making the contract seem to be most probable, and such understandings must bar out the particularly objectionable clauses as follows:

First. Disclaiming responsibility for soundings or other information as to the character of the work.

Second. The insertion of clauses which make any contractor's estimates worthless by adding, "or as otherwise directed."

Third. Making the contractor responsible for work for which engineers make the plans or require their approval to any made by contractor, and where engineers reserve the right to entirely control the manner and means of construction.

Fourth. Holding contractor responsible for work which has passed inspection or has been done under direction of engineer, or his agent, or inspector, unless fraud can be proved.

Fifth. Making the engineer the sole referee in settling all claims.

Sixth. The right to stop work, or any part of it, if for the interests of the company so to do, without allowing the contractor anything for the loss such action might bring to him.

When these clauses are eliminated and others substituted which give the contractor the benefit of the "intent" of the contract, and which will insure a settlement on that basis by disinterested parties, then comes the day of freedom for contractors.

[At this point in his paper Mr. Rollins refers to the paper on the "Uniformity of Requirements and Clearness of Specifications in Agreements for the Graduation of Railroads," by W. F. Dennis, read before the American Society of Civil Engineers. Abstracts of which, and also of the discussion on it, appeared in ENGINEERING-CONTRACTING Jan. 30, 1907, pages 45-47; Feb. 6, pages 53-58; and March 13, pages 112-116.]

SPECIFICATIONS.

Engineering is an exact science, and a specification must be explicit and cannot use the word *about;* and the main point in the interpretation is how much variation from the exact figures given can be allowed. We cannot get perfection; it is useless to try to get that in this world, and as its substitute, we must get as close as possible, and as practicable. It is a question of practicability *versus* perfection, and the man who has the good judgment to get the best practicable is the successful man.

For instance, "coarse, sharp sand shall be used." Does this mean that 27 per cent of this sand shall pass a 200 sieve, or that 86 per cent shall pass a 27 sieve? We never did nor do we ever hope to know. If size of sand is to be tested by a sieve test, specification should so state.

"*Cement* shall be of a well-established brand, shall be subject to inspection and rigorous tests of such character as engineer shall determine." Does this mean, in the entire absence of any detailed chemical composition, that we shall furnish cement having abnormal proportions of sulphuric acid, magnesium and of lime, either high or low?

"The stone used in the work shall be from one quarry, shall show no streaks or sap or other imperfections and shall be uniform in color." Does this mean that each single stone shall show no sap or streaks and shall be uniform in color, or does it mean that all the stone in the work shall be of the same color, with no streaks or sap?

Timber attached to masonry. "The contractor will be required to embed in or attach to the masonry sills and bearing timbers and such other timber as may be required."

Definition of timber, according to dictionary: "Wood fit for building; a piece of wood squared or sawed."

Can you conceive of a frame, with bolts and bearings, fitted for gates, for door frames, window frames, and I don't know but mosquito frames will come later, being considered as *timber,* to be set at a given price per thousand?

Should not specifications be explicit on these points, that a contractor can know on just what he is bidding?

The engineer should know what he wants when he writes his specification, and should state it, and not come around after the contract is signed, all material contracted for, and then bring out some special tests wanted, some wire factory work, or some special interpretations which the contractor never heard of.

If a contractor, bidding on public works to-day, ever tries to figure on all the chances which may come up, he never will get any contracts. He has to run the risk, to trust that some things will come his way, enough to balance the things that go against him. He doesn't want to be always kicking, making claims for extras, for small things, in the hope that the engineer will give him the benefit in doubtful cases, and such advantages as the work may offer, enough to offset his little extras. But when he doesn't get any of these benefits, especially if he feels that the engineer is willfully withholding them, is compelling him to do the work to the exact letter of the specifications, where such work is of no value to any one, when he is, in the common term of the profession, "getting roasted," then comes trouble, claims for extras, kicks and general eruptions.

DISCUSSION.

Mr. H. H. Carter: *First.* Contractors object to the present clause making the engineer referee to decide all questions relative to the *fulfillment* of the contract, and that his estimates and decisions shall be final and conclusive. It seems to me while the engineer is properly made the judge as to the fitness of materials, he certainly should not be referee to decide all questions relative to the *fulfillment* of the contract, and that questions of that sort should be decided by three parties, one to be appointed by the commission, one by the contractor, and these two to select a third. This provision you will find in force in the contracts drawn up by the Master Builders' Association.

Second. Contractors object to the clause stating that "if delay occurs on the part of the commission in furnishing the material, or if the contractor is delayed by other cause which is not his fault, the contractor shall have no damages on that account," etc. This is manifestly unfair.

Third. Some contracts contain a provision that in figuring the cost of extra work the contractor shall not be allowed to have superintendence, liability insurance, etc., figured in. As these are matters which all enter into the expense of the work, they should be taken into account in figuring the expense of extra work. Liability insurance in some instances amounts to 9 per cent of the pay roll, and there is no reason to leave it out as an item of expense in contract work.

Fourth. I think the time has now come when engineers should entirely revise the present form of contract and specifications and draw them up in a spirit of fairness to both contracting parties. The present form of contract arises from one engineer after another, assisted from time to time by a petty lawyer, endeavoring to alter the previous form of contract and introduce some ironclad clause, still further tying up the contractor body and soul and throwing on him the risk and expense of work which justly the other party to the contract should bear.

Fifth. All clauses requiring the contractor to do certain work at his own expense, "*unless otherwise directed*," should be done away with. Such clauses throw doubt on the good faith of the engineer and leave the contractor in doubt as to how he should make his figures, and also give him the idea that some other favored contractor knows in advance how the engineer will direct.

Sixth. All clauses should be done away with giving the right to the engineer to deprive the contractor of compensation for necessary work done under the contract. For instance, a recent sewer contract contains provision for 5-inch tongued and grooved sheeting driven below grade. The engineer has the right to order it taken out on the completion of the work if he so elects in which case the contractor receives no compensation for furnishing and driving it. If it is left in, however, he receives $70 per thousand feet board measure. This item alone on the particular contract referred to left the contractor in doubt as to whether or not he would receive any compensation for $40,000 worth of prescribed work. This is the kind of clause, when it is shown up in court or brought before the public, that throws suspicion on contractor and engineer alike. The idea that $40,000 worth of work *done* by the contractor may be paid for or not as the engineer decides, by a stroke of the pen, is one that sets ordinary people to thinking and does much to keep alive the continued talk of graft in connection with contracts.

Seventh. All clauses requiring the contractor to do work at his own expense when such work is not contemplated by the plans and specifications should be altered, and if such unexpected work is necessary, the clause should read that such work is to be done at the expense of the other party to the contract.

Mr. Charles G. Craib: There is a fictitious value created every time you add a hardship to the parties that are going to perform any service, and it seems to me that that feature ought to be considered in connection with a matter of this kind.

The general objection to general specifications is not that it is not wise to have a good strong set of specifications, so that the engineer can have control of the work, but it is that some engineers take advantage of that and neglect to give the contractor's side of the question proper consideration. At this time, when so many engineers have taken up the contracting business, some arrangement could be made by which a general form of specifications might be recommended that would be more in a spirit of fairness to the contractor and in justice to both parties to a contract.

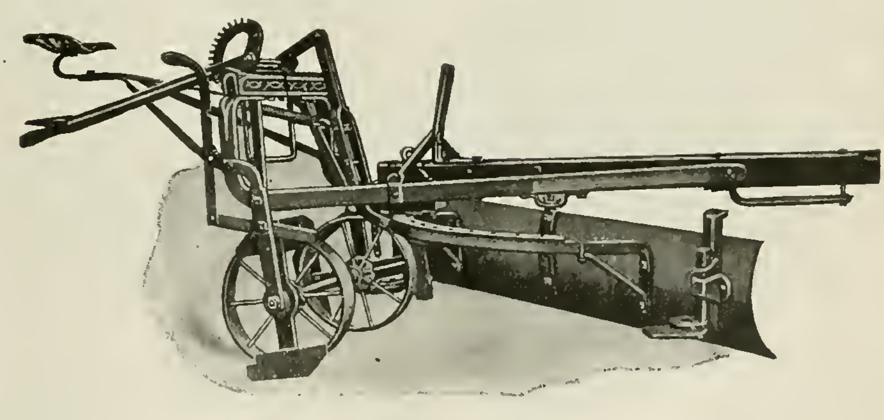
(To be continued.)

A Two-Horse Road Machine.

A road machine of the ordinary type requires from 4 to 8 horses to propel it, which prohibits its use under certain conditions, and makes the daily expense of operation considerable.

The White City Grader Co., of White City, Kansas, has put on the market a road machine or scraper drawn by two horses and operated by the driver.

As seen by the cut, the machine is small, yet the cutting blade is 6 ft. long, the same length as in the larger machine. The blade is reversible and can be operated at any angle. Owing to the compactness of the machine it can be used in small spaces and can be turned within its own length. The manufacturers claim that it is adapted for all the work that the larger machine can do on wagon roads, such as shaping the roadbed, excavating and ditching.



Small Road Machine with 6 ft. Cutting Blade.

The machine will dig a V-shaped ditch 15 ins. deep and 30. ins. wide. It is stated that this machine is especially adapted to leveling and ditching in the irrigated fields of the west. By setting the blade for very light cutting, weeds can be cleanly cut from the sides of roads. The makers have sold these scrapers to level up gravel roads and maintain them, and they state that they believe that the machine will do economical work in spreading broken stone for macadam roads.

One of the editors of this journal used a similar machine for this purpose, and, with it, reduced the cost of spreading macadam by 10 cts. per cu. yd. He found it advisable to do the rough spreading with the machine, and then used potato hooks to do the final shaping of the broken stone surface.

Another class of work that this machine will do as given in the catalog descriptive of it, is the leveling of earth dumped from wagons and the trimming and dressing of railroad beds. Both of these kinds of work are expensive to do by hand. See "Gillette's Earthwork and Its Cost," pp. 32 and 34, and ENGINEERING-CONTRACTING, April, 1906, p. 102, and Jan. 9, 1907, p. 14, where data on the subject can be obtained. A machine that will cut down these costs should be welcomed by contractors.

Cost of Excavating a Building Foundation.

In building a reinforced concrete car barn in Easton, Pa., excavation had to be made for the foundation of the walls and car pits. This was done with picks and shovels. In all 370 cu. yds. were excavated.

The majority of this was hauled by teams and was carried about 100 ft. from the barn. The material from some of the footings was thrown on the ground adjoining the pits. Laborers were paid $1.50 for ten hours; 2-horse teams with a driver received $3.67 for 10-hour day. The cost per cubic yard was 20 cents. This does not include the cost of foreman, but a reasonable allowance for a foreman who was paid $2.50 per day would be 3 cents per cubic yard. The contractor for the car barn was M. P. McGrath, of Easton, Pa. We are indebted for this information to Mr. J. F. Mooney, who is associated with Mr. McGrath.

Bids are now being taken by Frederick W. Skene, State Engineer and Surveyor of New York, for the construction of a large number of macadam roads under the state Good Roads law. In all 56 roads aggregating a total length of 240 miles are to be constructed. Bids for the work are to be opened at Albany, N. Y., on Nov. 18 and Nov. 21.

Diagram Showing Increasing Cost of Rock Excavation as Cuts Become Shallow.

BY L. N. JENSSEN, C. E.*

Both contractors and engineers have long been aware of the fact that the cost of rock excavation is much higher in shallow cuttings than in deep ones, and many a contractor has suffered heavy losses by line changes tending to make the cuts lighter after he had arrived on the ground with his outfit. I have, however, never seen an attempt made to show just what this increase in cost amounts to. This is what I intended to show as follows:

There are so many different factors governing the cost of rockwork, that it would be impossible to compute anything that would do under all circumstances. The information I give refers only to the particular country and conditions in and under which I made my observations. The diagram shows the average cost of rock excavation in a number of cuttings on two railroads running from Parry Sound to Sudbury along the Georgian Bay. The rock is granite, and of an extra hard and tough character. All drilling was done by hand and all haulage with teams and dragboats. Wages were $2 to $2.25 per day for labor and $3.50 per day for blacksmiths and foremen. Team and teamster was paid $5 per day. Neither foremen nor laborers were of the most efficient kind.

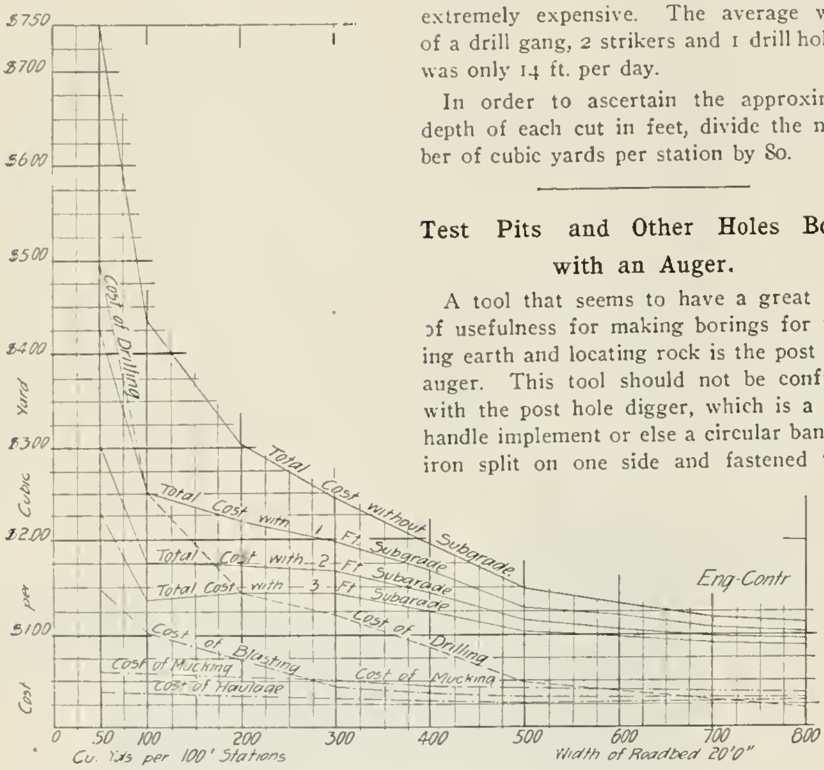


Diagram Showing Increasing Cost of Rock Excavation.

One railway allowed 1 ft. below grade in estimating pay yardage; the other allowed nothing. Both had separate classification for rock taken outside the theoretical slopes. In computing the quantities of the cuts all have been reduced to solid rock. The haul has been reduced to an average of 300 ft. The diagram shows the cost of the different items for cuttings running from 50 to 800 cu. yds. to the station of 100 ft. The width of the roadbed is 20 ft. Ditches have been calculated extra and added to the quantities of the cuts.

The diagram shows the reduction in cost per cubic yard by allowance of from 1 to 3 ft. below grade in estimating pay quantities, and indicates that a fair specification in this particular country should have allowed 3 ft. below grade in cuttings running up to 400 cu. yds. for station; 2 ft. in cuttings running from 400 to 500 cu. yds. for station; and 1 ft. in heavier cuttings.

The drilling was, as the diagram shows, extremely expensive. The average work of a drill gang, 2 strikers and 1 drill holder, was only 14 ft. per day.

In order to ascertain the approximate depth of each cut in feet, divide the number of cubic yards per station by 80.

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*Key Harbor, Ontario, Canada.

Test Pits and Other Holes Bored with an Auger.

A tool that seems to have a great field of usefulness for making borings for testing earth and locating rock is the post hole auger. This tool should not be confused with the post hole digger, which is a split handle implement or else a circular band of iron split on one side and fastened to a long handle. The digger is operated by a man driving it into the ground with some force. The auger illustrated in the cut is worked by turning it from side to side at the same time giving it some downward pressure. The auger like the digger was originally intended for digging holes for fence posts, but, inasmuch as the auger cuts a smooth hole of the diameter of the auger and not such a ragged hole as the digger, the auger hole can be driven to a much greater depth.

The handle on the small sizes is 4 ft. long, while a 6-ft. handle is used on the larger sizes. For ordinary purposes these lengths are sufficient, but for boring test holes the handle is readily lengthened by attaching additional pipe of the same size as the handle. This pipe can be taken off and put on in lengths as the auger is raised and lowered in the hole, or a small derrick can raise it in sections and these sections be uncoupled.

As the core of earth that the auger bores out is raised to the surface, samples can be taken and the depth recorded. If the ground is found to be too dry to dig easily holes can be punctured in the pipe near the auger and by turning water into the pipe, enough moisture can be obtained at the bottom of the hole to help the digging and compact the core so that it can be brought to the surface, even if it is fine dry sand.

With a 10-in. auger, holes 35 ft. deep have been bored, while with a 4 in. auger a depth of 75 ft. has been obtained. Where a large number of shallow holes, from which specimens are to be taken are needed, this auger should give excellent results.

Wells can be driven in the same manner that the test holes are put down, but the hole should be lined, at least near the top, when it is desired to use it for a well. It is stated that in one instance two men sunk a hole 16 ft. deep in a half a day. With wages at $1.50 per day this means a cost of 9.4 cts. per lineal foot of hole. This appears to have been a light cost. Naturally the deeper the hole the slower the work, which means to quickly increase the cost per lineal foot.

The large size auger has been used for digging holes for telephone poles, the base of which does not measure more than 13 ins. in diameter. Two men operate it for this work, and holes are readily put down in earth to a depth of 4 or 5 ft. It is stated that 2 men with a 12-in. auger have put down 50 holes, 5 ft. deep, in one day. On the wages at $1.50 for 10 hours this means only a cost of 1.2 cts. per lineal foot of hole dug, 6 cts. per hole or 41 cts. per cubic yard of earth excavated. A smaller size auger can be used to dig holes for anchors needed for the telephone poles.

Post Hole Auger.

In our issue of Aug. 28, 1907, page 133, the cost of digging post holes for a fence with an auger is given. With wages at $1.50 per 10 hours, 84 holes being dug with a 6-in. auger, the cost per hole was 1.8 cts., or .7 ct. per lineal foot, which gives a cost of 98 cts. per cubic yard.

The style of auger shown in the cut is manufactured by Iwan Bros. of Streator, Ill. It is made of two steel blades, each blade with two cutting edges. The blades interlock at the bottom in the notches made for that purpose, thus holding the dirt, which is released by rapping the flat side of the blade on the ground. The auger is made in ten sizes from 3 ins. to 14 ins.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

The Cost of Six Tool Houses.

In this article we give the cost in detail of building six frame tool houses for use on railroads. The labor was performed by company forces. The costs are summarized so as to allow of comparison with other cheap structures, like those that have appeared in our previous issues in this series of articles.* Lists of materials and prices are given as well as wages. The cost of lumber was very low.

Example I: Tool House 8x12 ft.; area 96 sq. ft.

Weight:	Pounds.
1,000 ft. B. M. at 3,300 lbs	3,300
1¼ M. shingles at 150	188
Hardware	50
Total, 1¾ tons	3,538

Lumber:	
323 ft. B. M. at $9	$ 2.91
630 ft. B. M. at $11	6.93
48 ft. B. M. flooring, $20	.96
1,001 ft. B. M. total at $10.80 (av.)	$10.80
1¼ M. shingles at $1.80	$2.25
Hardware:	
Bolts	$ .82
3 lbs. 3d nails, $2.76	.08
10 lbs. 8d nails, $2.35	.24
5 lbs. 20d nails, $2.25	.11
1 gal. paint	.60
2 pr. 8-in. tie hinges, 4 ct	.08
1 8-in. hinge hasp, 5 ct	.05
½ gross 1-in. No. 10 screws, 14 ct	.07
1 Yale padlock	.43
Total	$2.48
Labor:	
Engineering	$ 1.65
.Building house, 4.5 days, carpenter, $2.50	11.25
Total	$12.90
This includes painting.	
Tools	$ .48

SUMMARY.

Materials:	Totals.	Pct.
1,001 ft. B. M. at $10.80	$10.80	38.0
Shingles	2.25	7.4
Hardware	2.48	8.5
Total materials	$15.53	53.9
Labor:		
Engineering	$ 1.65	5.7
Carpenter	11.25	38.9
Total labor	$12.90	44.6
Total materials and labor	$28.43	98.5
Tools	.48	1.5
Freight	.00	0.0
Grand total	$28.91	100.0

	Cost per sq. ft.	Pct.
Materials	$ .161	53.9
Labor	.134	44.6
Tools	.005	1.5
Total	$ .300	100.0

It will be noted that the carpenter labor, as above given, cost $11.25 per 1,000 ft. B. M. in the tool house.

Example II: Tool house 12x14 ft. and oil house 10x32; area 168 sq. ft. and 320 sq. ft. Total area 488 sq. ft.

Weight:	Pounds.
Lumber and mill work	13,700
5½ M. shingles at 150	825
Hardware and paint	200
Total 7½ tons	14.725

Lumber:	
416 ft. B. M., at $9	$ 3.74
700 ft. B. M., at $12	8.40
1,360 ft. B. M., at $8.50	11.56
1,100 ft. B. M., at $12	13.20
450 ft. B. M., at $9	4.05
4,026 total at $10.17 (av.)	$40.95
Mill work:	
Battens	$ 1.92
1 door frame and door	2.95
2 window frames and sash	5.90
Total	$10.77
5½ M. shingles at $1.45	$ 7.98
Hardware:	
100 lbs. 8d nails	$2.56
20 lbs. 30d nails at $2.46	.49
1 hasp	.05
2 hinges and hasps	.10
1 pair butts	.04
20 lbs. 6d nails at $2.66	.53
1 galv. iron chimney	1.04
	$4.81
Paint:	
6 gal. outside body paint. 75 cts	$4.50
1 gal. outside trim paint	.70
½ gal. turpentine	.22
¼ gal. Japan dryer	.20
	$5.62
Labor:	
Building tool and oil house:	
Carpenters, 20 days, at $2.50	$50.00
Putting up shelving:	
Carpenter, 4 days, at $2.50	10.00
Painting, helper, 1 day, at $1.75	1.75
Total labor	$61.75
Tools	$2.34

SUMMARY.

Materials:	Totals.	Pct.
4,026 ft. B. M. at $10.17	$40.95	30.5
Mill work	10.77	8.0
Shingles	7.98	5.9
Hardware	4.81	3.5
Paint	5.62	4.1
Total material	$70.13	52.0
Labor:		
Building	$ 60.00	44.7
Painting	1.75	1.3
Total labor	$ 61.75	46.0
Total material and labor	$131.88	98.0
Tools	2.34	2.0
Freight	.00	.0
Grand total	$134.22	100.0

	Cost per sq. ft.	Pct.
Materials	$0.144	52.0
Labor	0.126	46.0
Tools	0.005	2.0
Total	$0.275	100.0

It will be noted that the labor cost about $15 per M.

It is noteworthy in this instance to record that the foreman carpenter on this job was discharged for inefficiency, owing to the high cost of building these two sheds. One of these buildings had windows in it and shelving, which should have made the labor costs higher than in Example I, where neither windows nor shelves were used. A comparison shows that the cost per square foot of area in Example II was lower than in all the cases given except Example V. The cost was 2½ cts. lower than Example I, 1 ct. of which was in the reduced cost of labor. This makes evident the fact that cost data and their analysis form the only true way of telling of the efficiency of workmen and methods, provided the records are kept honestly and intelligently.

Example III: Tool house 8x12 ft.; area 96 sq. ft.

Weight:	Pounds.
1,110 ft. B. M. lumber at 3,300	3,663
1 1/5 M. shingles at 150	180
Hardware and paint	50
Total, 2 tons	3.893

Lumber:	
758 ft. B. M. at $10.50	$ 7.95
352 ft. B. M. at $7.50	2.64
1,110 ft. B. M. total at $9.54 (av.)	$10.59
1,200 shingles at $1.90	$228
Hardware:	
3-in. bolts	$1.60
5 lbs. 20d nails at $2	.10
5 lbs. 8d nails at $2.10	.11
10 lbs. 10d nails at $2.05	.20
Total	$2.01
Paint:	
2 gal. outside body paint at 60 cts	1.20
Labor:	
Loading material for tool house:	
Carpenter 1 day at $2.50	$ 2.50
Erecting tool house:	
Carpenter 2 days at $2.50	5.00
Helper 6 days at $2	12.00
Total	$19.00
This includes painting.	
Tools	$1.57

SUMMARY.

Materials:	Totals.	Pct.
1,110 ft B. M. at $9.54	$10.59	28.8
1,200 shingles at $1.90	2.28	6.2
Hardware	2.01	5.5
Paint	1.20	3.3
Total material	$16.08	43.8
Labor	$19.00	51.9
Total materials and labor	$35.08	95.7
Tools	1.57	4.3
Freight	0.00	0.0
Grand total	$36.65	100.0

	Cost per sq. ft.	Pct.
Materials	$0.167	43.8
Labor	0.198	51.9
Tools	0.016	4.3
Total	0.381	100.0

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*See Engineering Contracting Oct. 9, Sept. 11, and Aug. 28, for costs of station buildings, section houses and ice houses.

It will be noted that the labor cost nearly $17.50 per M., which is excessive.

Example IV: Tool house 8x12 ft.; area 96 sq. ft.

Weight:	Pounds.
1,247 ft. B. M. at 3,300 lbs.	4,115
1¼ M. shingles at 150	187
Hardware and paint	65
Total, 2 tons	4,367

Lumber:	
577 ft. B. M. at $7	$4.04
180 ft. B. M. at $7	1.26
490 ft. B. M. at $8	3.92
1,247 ft. B. M. total at $7.40 (av.)	$9.22
1¼ M. shingles at $1.50	$1.87

Hardware:	
10 lbs. 20d nails at $2.46	$ .25
20 lbs. 8d nails at $2.56	.51
5 lbs. 3d nails at $2.91	.15
2 prs. hinges	.12
1 hasp	.05
1 padlock	.16
Total	$1.24

Paint:	
4½ gals. outside body paint at 75 cts.	$3.38
½ gal. boiled oil at 70 cts.	.35
Total	$3.73

Labor:	
Carpenter 3 days at $2.50	$ 7.50
Carpenter 1 day at $2.25	2.25
Helper 1 day at $1.75	1.75
Painting, helper 1 day at $1.75	1.75
Total	$13.25
Tools	.95

SUMMARY.

Materials:	Totals.	Pct.
1,247 ft. B. M. at $7.40	$ 9.22	30.4
1¼ M. shingles at $1.50	1.87	6.1
Hardware	1.24	4.1
Paint	3.73	12.3
Total materials	$16.06	52.9
Labor:		
Building	$11.50	38.0
Painting	1.75	5.7
Total labor	$13.25	43.7
Total material and labor	$29.31	96.6
Tools	.95	3.4
Freight	.00	0.0
Grand total	$30.26	100.0

	Cost per sq. yd.	Pct.
Materials	$0.167	52.9
Labor	0.138	43.7
Tools	0.001	3.4
Total	$0.306	100.0

It will be noted that the labor cost $10.50 per M.

Example V: Double tool house 12x30 ft.; area 360 sq. ft.

Weight:	Pounds.
2,606 ft. B. M. at 3,300 lbs.	11,365
3½ M. shingles at 150 lbs.	525
Hardware	75
Total, 6 tons	11,965

Lumber:	
1,019 ft. B. M. at $8	$ 8.15
708 ft. B. M., s. 1 s., at $8.50	6.02
879 ft. B. M. at $8	7.03
288 ft. B. M. at $8.50	2.45
232 ft. B. M. at $8	1.86
318 ft. B. M. at $4	1.27
3,444 ft. B. M. total at $7.77 (av.)	$26.78
3½ M. shingles at $1.40	$4.90

Hardware:	
20 lbs. 4d nails at $3.80	$ .76
6 lbs. 20d nails at $3.50	.21
8 lbs. 8d nails at $3.60	.29
24 lbs. 10d nails at $3.55	.85
6 lbs. 30d nails at $3.50	.21
4 pairs hinges	.48
2 pairs hasps	.14
2 Yale padlocks	.88
Total	$3.82

Labor:	
Carpenter 12.1 days at $2.50	$30.25
Tools	2.21
Freight	.76

SUMMARY.

Materials:	Totals.	Pct.
3,444 ft. B. M. at $7.77	$26.78	39.0
Shingles 3½ M. at $1.40	4.90	7.2
Hardware	3.82	5.6
Total materials	$35.50	51.7
Labor	$30.25	43.8
Total materials and labor	$65.75	95.5
Tools	2.21	3.3
Freight	.76	1.2
Grand total	$68.72	100.0

	Cost per sq. ft.	Pct.
Materials	$0.098	51.7
Labor	0.084	43.8
Tools	0.007	3.3
Freight	0.002	1.2
Total	$0.191	100.0

It will be noted that the labor cost $8.60 per M.

Example VI: Tool house 8x12 ft.; area 96 ft.

Weight:	Pounds.
1,247 ft. B. M. at 3,300 lbs.	4,115
1¼ M. shingles at 150	187
Hardware	60
Total, 2 tons	4,362

Lumber:	
577 ft. B. M. at $7	$4.04
180 ft. B. M. at $7	1.26
490 ft. B. M. at $8	3.92
1,247 ft. B. M. total at $7.39 (av.)	$9.22
1¼ M. shingles at $1.50	$1.87

Hardware:	
Bolts	$ .42
10 lbs. 20d nails at $2.46	.25
20 lbs. 8d nails at $2.56	.51
5 lbs. 3d nails at $2.91	.15
2 pairs hinges	.12
1 hasp	.05
1 padlock	.16
Total	$1.66

Paint:	
2½ gals. outside body paint at 75 cts.	$1.88
½ gal. oil at 70 cts.	.35
	$2.23

Labor:	
Carpenter 6.3 days at $2.50	$15.75
Carpenter 1 day at $2.25	2.25
Helper 2.5 days at $1.75	4.37
Total	$22.37
Tools	.92

SUMMARY.

Materials:	Totals.	Pct.
1,247 ft. B. M. at $7.39	$ 9.22	24.0
1¼ M. shingles at $1.50	1.87	4.9
Hardware	1.66	4.3
Paint	2.23	5.9
Total materials	$14.98	39.1
Labor	22.37	58.4
Total materials and labor	$37.35	97.5
Tools	.92	2.5
Freight	.00	0.0
Grand total	$38.27	100.0

	Cost per sq. ft.	Pct.
Materials	$0.156	39.1
Labor	0.233	58.4
Tools	0.001	2.5
Total	$0.390	100.0

It will be noted that the labor cost $18 per M., which is excessive.

A number of these tool houses were 8x12, giving 96 sq. ft. of area in the building and needing for their construction a little more than a thousand feet of lumber. Their cost ran from $28 to $38. A comparison of these buildings with the cost of building a large number of shacks for camps in building railroads in the south will be of interest. These camps were built by one of the editors of this journal.

They were about 10x10, and had a slanting roof. A door made from boards was used in it, and a sliding board window was put in one side. A bunk was also built in it, but there was no floor. A thousand feet of lumber was used in building the shack. The roof was covered with tar paper, and strap hinges, hasp and padlock were used on the door. The lumber on a large number built in Tennessee cost $10 per M.; the tar paper, nails and hardware cost $2, making a cost of materials of $12. Carpenters were paid $3.50 per day and 3 carpenters completed a building in a day, making a cost of about $10 for labor, or a total cost of $22 per shack.

A comparison with the tool houses shows that if paint and shingles had been used these shacks would have cost a few dollars more for materials and slightly raised the cost of labor; but wages paid by the contractor on the shacks were $1 per day higher, which about offsets the increased cost of materials.

We have pointed out before that a contractor who pays $3.50 a day for carpenters will usually get more work for the money than will a railroad company that pays $2.50 to its carpenters. A comparison of the cost of labor per square foot as listed above with 10 cts. per square foot as paid for these shacks shows plainly that this is true.

Time of Freight Cars Lost in the Repair Shop.

The number of freight cars constantly in repair shops was 5 per cent of the total number for the three months ending March 31, according to Statistical Bulletin No. 4 of the American Railway Association. For the previous quarter the percentage was 5½ per cent. Each car averaged 23½ miles traveled per day. The above figures are based upon averages of almost two million freight cars. In Group IV (Virginia, West Virginia, North and South Carolina) there were 124,000 cars, 7 per cent of which were in the repair shop at any one time. This group made the poorest showing of all.

Estimates submitted to the Board of Estimate and Apportionment of New York City show that $140,000,000 will be required to run the various city departments during 1908.

Methods and Costs; Some Old; Some New.

Straightening a Standpipe.—A standpipe, 22x100 ft. high, soon after it was completed, was found to lean about 30 ins. at the top. The foundation of the tower consisted of a concrete pier 22 ft. in diameter at the top, 25 ft. in diameter at the base and 8 ft. deep. This pier rested upon a clay soil, hard and uniform in character. The cause of the leaning was unequal settlement of this foundation. When this settlement was discovered the water was at once let out of the standpipe and steps taken to straighten it. To do this an excavation 3 ft. wide was carried down the depth of the foundation and entirely round it. Four concrete piers, 6 ft. long, projecting 3 ft. under the old foundation were then put in. These piers were 3 ft. wide on the bottom, 2 ft. wide on the top and 3 ft. deep. When they were in place, the soil under the old foundation was bored out and the monolithic foundation allowed to settle down on the piers, from which the standpipe was easily gotten back into a vertical position. A rubble masonry footing, 3 ft. deep, extending for 3 ft. under the old foundation, was then put in between the piers.

Labor Cost cf Moving a Frame Dwelling House.—This building was moved at Secaucus, N. J., during the month of July, 1906, under contract, to make room for freight yard extensions. The house (weighing about 50 tons) was 30 ft. square, two stories in height, with a one-story extension in the rear 12x18 ft., all resting upon brick piers standing 2 ft. above level of ground. The building was first raised about 14 ins. with jack screws and blocking. Several long 12-in.x12-in. timbers were then placed under the joists lengthwise and crosswise, all properly cleated and fastened, care being taken to support the two chimneys. The movement was accomplished with windlass, team, driver and about 1,000 ft. of 2-in. manilla rope passed through the blocks, the building sliding forward upon greased supports of way of long timbers blocked up to the proper height. It was moved forward a distance of 115 ft., then turned about 90 degrees and pulled backward a distance of 435 ft. to its new location, making a total distance traveled of 548 ft.

During the moving the force was kept busy greasing timbers with soap and carrying blocking forward. At intervals the moving was stopped, the team detached from the windlass and used to haul the long timbers ahead. In moving it was necessary to cross over two roads and pass under three lines of light and telephone wires. Men were stationed upon the top of the house to lift the wires over the roof and chimneys. Previous to moving, the building was strengthened to prevent racking, by placing several temporary bents in rooms on first floor. The only damage occurred from plaster cracking around chimneys, and this was slight. The tenants occupied house during moving period.

Wages for laborers were $2.00 per day, hours from 7 a. m. to 6 p. m., and half days on Saturday, for which they received a full day's pay. The foreman received $3.50 per day, utility man $3.00 per day, night watchman $2.00 per day. Teams were paid at the rate of $1.50 per day and 75 cts. per day was paid for a horse. During the moving drivers worked as laborers.

The actual labor cost is divided as follows:

		Per Cent.
Hauling blocking, lumber and tools (9 miles for round trip)	$ 27.00	9.1
Placing and removing blocking timbers, raising and lowering before and after moving	102.00	34.5
Moving building (548 ft)	166.75	56.4
Total moving	$295.75	100.0

The time occupied in doing the work including the time lost for Sundays, holidays and rain was 24 days. Actual number of days worked was 16. The total cost of this moving to contractor was $357.50, the extra $61.75 (added to $295.75) being wages paid to foreman, 2 drivers and watchman for Sundays, holidays and days lost on account of rain.

For the above information we are indebted to Mr. A. L. Moorshead, C. E.

Searching Out and Repairing Reservoir Leak.—A leak which had been in existence over 25 years, in the Hope reservoir at Providence, R. I., was repaired last year. The method of searching out the source of the leak and repairing it was described in the last annual report of the City Engineer, Otis F. Clapp. The water from the leak appeared at the foot of the bank on the west side of the reservoir, and had been taken care of by a pipe well from which it was discharged into a sewer. Last May the water was drawn off for cleaning the reservoir, and advantage was taken of the fact to discover the source of the leak. When the water had been drawn down so that there was a head of about 1 ft. on the discharge, work was commenced, tracing the course of the leak back to its source. A water channel was at once found, measuring from 2 to 4 ins. high and from 4 to 8 ins. wide, and nearly level. This was followed some 54 ft. in open trench and then tunneling was commenced. At a point about under the outer top edge of the embankment it was found that the channel divided and ran in nearly opposite directions. Colored water was then forced back into the reservoir by way of each of the two routes, the color appearing at the same point on the surface of the water in the reservoir, showing that both routes had the same source. The reservoir was then emptied and cleaned and the tunneling continued by way of both branches. The stone slope was taken down where the colored water had appeared, and a hole several inches in diameter was found which went back into the bank several feet and then branched and ran in opposite directions. The tunneling was prosecuted until the lines met, every effort being made to find any side openings that might lead away; a few of these were found and followed to the end. The material of the embankment was found to be hard and in the best of condition, only a few soft places being discovered, and these, all near the water course, were completely removed. The tunnel was about 4 ft. high and 2½ ft. wide and measured 251 lin. ft. in length. In addition there was the 54 ft. of open cut. The water course in the embankment measured 359 lin. ft. In making the repairs that portion of the bank lying over the tunnel excavation was taken out and the embankment rebuilt. The water channel was found to have been about on the surface of the original soil, or where the artificial work in building the embankment was begun. In repairing the precaution was taken to go down lower in the line of the core wall, finding rock from 2 to 5 ft. below where the embankment had been started before, and filling in with concrete. The excavation was then refilled with great care, some three car loads of Barrington clay being added to the soil taken out before replacing.

According to statistics gathered by the Archiv für Eisenbahnwesen of Berlin, at the end of 1905, the railways in operation throughout the world totaled 562,783 miles in length and represented a construction capital of more than $40,000,000,000.

Recent acts of Parliament authorize the construction of some 200 additional miles of railway in the United Kingdom, involving an outlay exceeding $50,000,000. The authorized constructions include railway extensions in the Midlands and other parts of the kingdom, and various dock improvements at railway termini. The chief item is a projected railway in Ireland over 100 miles long, terminating on the west coast, and forming a link in a future route between England and Canada by rail across Ireland and by a direct steamship line from Blacksod Bay.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. If anything not described in our columns is wanted tell us its name, otherwise just send us the numbers of the catalogs wanted, with your name, on a postal card, and we will forward the request to the manufacturers, thus enabling us to give them indisputable proof that our readers are interested in their products. You will confer a favor on us, therefore, if you will order your catalogs through us.

No. 0420. **Concrete Block Machines.**—The Abbey-Dodge-Brooks Concrete Company, Newark, N. J.

This company manufactures a concrete block machine and also a machine for making concrete bricks. These machines are illustrated and described briefly and the advantages of each are stated. The company also manufactures molds for columns, balusters, and other ornamental objects.

No. 0421. **Tobin Bronze.**—Ansonia Brass & Copper Co., New York, N. Y.

The physical properties of Tobin Bronze are briefly described in this pamphlet. This descriptive matter is followed by records of a number of tests made on samples of Tobin Bronze. There are also a number of testimonial letters from firms who have used the material.

No. 0422. **Gas Producers.**—Wile Power Gas Co., Rochester, N. Y.

The gas producer described and illustrated in this catalog is a suction gas producer. The pamphlet tells what producer gas is and how suction producer gas is made. . The Wile producer is then described in very complete detail. line drawings being given of the several parts and the method of operation being fully explained. The pamphlet also contains a complete specification for these producers and shows illustrations of several producer gas engine plants.

No. 0423. **Stone Crushing Machinery.**—Allis-Chalmers Co., Milwaukee, Wis.

One of these two pamphlets describes and illustrates the construction of the Gates Crusher. The other pamphlet shows pictures and describes the construction of a large number of stone and ore crushing plants. These plants are shown by means of line drawings. and altogether furnish a really valuable set of plans for the use of the engineer and contractor.

No. 0424. **Graphite Paint.**—Detroit Graphite Mfg. Co., Detroit, Mich.

This pamphlet contains a collection of handsome half-tones of bridges and viaducts which have been painted with superior graphite paint. Among the bridges pictured is the Victoria Jubilee bridge across the St. Lawrence River at Montreal, Canada, which now that the Quebec bridge has fallen ranks as the most pretentious bridge structure of eastern Canada.

No. 0425. **Dredging Contractors.**—North American Dredging Co., San Francisco. Cal.

This pamphlet shows a number of pictures of the dredges owned and operated by the company named. The company contracts for all kinds of dredging work and will undertake to deliver earth through a pipe line 2 miles long and to an elevation 20 ft. above water line. The hydraulic dredges "Atlantic" and "Pacific" as shown are particularly handsome machines.

No. 0426. **Machine Tools.**—The Fairbanks Co., New York and Chicago.

This cloth bound book contains 613 pages and is one of the most complete catalogs of machine tools that we have ever seen. The idea in getting up the book has not been to exploit or explain any particular line or kind of machine tools but to catalog by picture, specification and description all kinds of standard tools for both metal and wood working. As a reference and order book for the machine shop it is invaluable. A complete index enables quick reference to any class of tools.

No. 0427. **Oil Engines.**—De La Vergne Machine Co., New York, N. Y.

This circular illustrates and describes in some detail the above named company's two-cycle oil engine. This machine has been devised for power users who desire engines of small size and moderate price to burn kerosene or distillates of moderate cost; it is not a gasoline engine The machine is an interesting one and deserves attention by contractors.

No. 0428. **Reinforcing Metals.**—Trussed Concrete Steel Co., Detroit Mich.

The three circulars describe and give tables of bar spacing and slab tables for Kahn trussed bar, cup bar and rib metal reinforcement. They are worth securing.

No. 0429. **Conveying and Traosmission Machinery.**—Stephens-Adamson Mfg. Co., Aurora, Ill.

This set of bulletins, one of which is published every month, gives some excellent discussions and tabular matter relating to conveying and transmission machinery of various kinds and for various purposes. The reader interested in such machinery should apply to be put on the mailing list for this bulletin.

No. 0430. **Concrete Barrows and Carts.** Sterling Wheelbarrow Co., Milwaukee, Wis.

This pamphlet is devoted especially to the barrows and carts which this company makes for handling concrete. There are all-metal and also wooden frame barrows. The carts are 5½ and 7½ cut. ft. capacity and are provided with legs which permit them to stand filled without holding. This line of carts and barrows is well worth looking into by concrete workers.

No. 0431. **Concrete Separators for Wall Forms.**—Abbey-Dodge-Brooks Concrete Co., Newark, N. J.

This pamphlet illustrates a hollow concrete separator intended to be used in place of wood or gas pipe separators in form work for walls. The separator is slipped over the bolt connecting the two sides of the form. holding the sides apart and at the same time permitting the bolt to be withdrawn easily when the forms are removed. For molding holes in floor slabs a hollow concrete sleeve is made which is held upright on the slab lagging by a nail which is removed after connecting. leaving the sleeve with its center hole embedded in the concrete.

No. 0432. **"The Drill Hole."** The Cyclone Drill Co., Orrville, Ohio.

This is the name of a monthly bulletin that is being issued by the company named to illustrate and explain the use of core drills and methods' of doing core drilling work. The bulletins so far issued contain much interesting matter and those interested will do well to be included on the mailing list.

No. 0433. **Tape Splice.** Clinton B. Alexander, Clearfield, Pa.

This circular illustrates a simple and effective device for splicing steel tapes in the field. The splice can be applied with no other tool than a jack knife, does not injure the tape for future permanent repair and is cheap and so small that several can be carried in the vest pocket.

Personals.

Mr. Z. E. Sevison has been appointed Assistant City Engineer of Cheyenne, Wyo.

Mr. F. J. Marshall has been appointed County Highway Engineer of Green County, Missouri.

George Frederick Bodley, one of the most eminent architects of Great Britain died recently in London.

Mr. B. W. Hicks has been appointed Chief Engineer of the Wisconsin & Michigan Ry., with headquarters at Peshtigo, Wis.

Mr. Edmund F. Van Hoesen has been appointed Chief Engineer of the Tonopah & Goldfield R. R., with headquarters at Tonopah, Nev.

Mr. W. J. Young has resigned his position as Chief Engineer of the Lehigh & New England R. R., and will engage in business at Martins Creek, Pa.

Mr. Oscar P. Wodack has been placed in charge of the office and warerooms of the Cincinnati Electrical Tool Co.'s office, recently opened at 18th and Rockwell Sts., Chicago, Ill.

Mr. Dan McDermott, for the past 16 years Superintendent of the Arizona Canal for the Arizona Water Co., has resigned that position and will devote all his time to his ranch near Phoenix, Ariz.

Mr. H. Hobart Porter of Sanderson & Porter, Engineers, 52 William St., New York City, has been appointed Consulting Engineer for the Interborough Metropolitan Co., of New York City.

Mr. John O'Neill has resigned his position as Track Elevation Expert of the City of Chicago. According to press reports Mr. Walter J. Raymer, at present City Purchasing Agent, will succeed Mr. O'Neill.

Charles E. Hequembourg, M. Am. Soc. C. E., of Dunkirk, N. Y., died suddenly last week, at his home in that place. Mr. Hequembourg was at one time mayor of Dunkirk and was a well known civil engineer.

Capt. H. W. Stickle, U. S. Corps of Engineers, heretofore on duty at West Point. N. Y., as assistant to the officer in charge of construction, has been ordered to Culebra. Canal Zone, for duty in connection with the construction of the Gatun Locks.

Mr. John H. Barrett, for some time engineer of construction on the New Castle, Butler & Pittsburg Street Ry., at New Castle, Pa., has resigned his position and has gone to Baker City, Ore., where he has accepted a position with a mining company.

Mr. R. S. Clemmons. formerly Manager of the Engineering Department of Dodge & Day, of Philadelphia, Pa., has become associated with the Ley Construction Co., as Southern Manager.. He will have charge of all that company's business south of Baltimore.

Mr. J. M. Floesch, M. Am. Soc. C. E., has resigned his position as Chief Engineer of the Buffalo, Rochester & Pittsburg Ry., and will be associated with a construction company that has a contract for building a large portion of the Grand Trunk Pacific in Canada.

Mr. C. K. Koppes has resigned his position as Assistant Engineer of the Chicago, Milwaukee & St. Paul Ry., with headquarters at Milwaukee, Wis., in order to accept the appointment of Resident Engineer of the Cleveland Short Line Ry., with headquarters at Cleveland,, O.

Jonathan Wainwright. President of the Drake & Stratton Co., Contractors, of Philadelphia, Pa., died Oct. 17, at his summer home, at Ogdensburg, N. Y. Mr. Wainwright had been ill for several months and left his home in Philadelphia early in June to travel for his health. He was 57 years old.

Prof. Louis Erhart Reber, Dean of the School of Engineering, at Pennsylvania State College, and Professor of Mechanical Engineering in that institution for the past 20 years, has been appointed Director of the University Extension and Correspondence Study of the University of Wisconsin.

The Southwestern Bridge Co., of Joplin, Mo., has opened contracting offices as follows: 806 Wilson Bldg., Dallas, Tex., Mr. J. I. Boggs, Contracting Engineer; 317 Culbertson Bldg., Oklahoma City. Okla., Mr. R. X. Basford, Contracting Engineer; 726 Symes Bldg., Denver, Colo., Mr. George A. Sears, Contracting Engineer.

Mr. Franklyn B. Ware, of New York City, has been appointed State Architect of New York, to fill the vacancy caused by the death of Geo. L. Heins. Mr. Ware was graduated from the Architectural course at Columbia University in 1894 and in 1896 became a member of the firm of J. E. Ware & Sons, Architects, of New York.

The following appointments to the position of Resident Engineer have been made by Frederick W. Skene, State Engineer of New York: C. F. Chism, E. J. Pickwick, W. H. Van Nie, T. R. Ripley, F. J. Wagner, C. A. Ingersoll, T. J. Morrison, O. F. Bellows, F. C. Davis, E. Styring, J. A. O'Connor, C. H. McCullough and Herbert Spencer. The appointees have been in the State Engineer's Department for many years and nearly all have made Albany, N. Y., their home.

The following have been appointed by Governor Deneen of Illinois as delegates to the National Drainage Congress to be held at Baltimore, Md., Nov. 22 to 27: John W. Alvord, Lyman E. Cooley, and Isham Randolph, of Chicago, Ill.; J. G. McIluish and A. H. Bell, of Bloomington, Ill.; J. A. Harman and Dabney H. Maury, of Peoria, Ill.; J. W. Dappert and J. M. Taylor, of Taylorville, Ill.; L. W. Low, Jr., and J. H. Harden, of Fairfield, Ill.; H. F. Pain, Urbana, Ill.; Frank H. Haynes, Genesee, Ill., and G. A. McWilliams, Walnut, Ill.

The following officers were elected at the last annual convention of the Association of Railway Superintendents of Bridges and Buildings: President—R. H. Reid of Cleveland, O., of the Lake Shore & Michigan Southern Ry.; First Vice-President—John P. Canty of Fitchburg. Mass., of the Boston & Maine Ry.; Second Vice President—H. Rettinghouse of Boone, Ind., of the Chicago & Northwestern Ry.; Third Vice President—F. E. Schall of South Bethlehem, Pa., of the Lehigh Valley Ry.; Fourth Vice President—William O. Eggleston of Huntington, Ind., of the Erie Ry.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Oct. 30.	Toledo, O.	Oct. 16
Oct. 30.	Williamsport, Md.	Oct. 16
Nov. 1.	Calgary, Alberta	Oct. 23
Nov. 1.	Winnipeg, Man.	Oct. 30
Nov. 1.	Indiana, Pa.	Oct. 30
Nov. 1.	Waco, Tex.	Oct. 30
Nov. 4.	Ashland, O.	Oct. 16
Nov. 4.	Jasper, Ind.	Oct. 23
Nov. 4.	Angola, Ind.	Oct. 23
Nov. 4.	Lancaster, Pa.	Oct. 30
Nov. 4.	Greenville, Miss.	Oct. 30
Nov. 4.	Washington, D. C	Oct. 30
Nov. 4.	Wichita, Kan.	Oct. 30
Nov. 4.	Sacramento, Cal.	Oct. 30
Nov. 4.	Wichita, Kan.	Oct. 30
Nov. 4.	Huntington, Ind.	Oct. 30
Nov. 4.	Crown Point, Ind	Oct. 30
Nov. 5.	Millvale, Pa.	Oct. 16
Nov. 5.	Vincennes, Ind.	Oct. 23
Nov. 5.	Paoli, Ind.	Oct. 23
Nov. 5.	Sundance, Wyo.	Oct. 30
Nov. 6.	Muncie, Ind.	Oct. 23
Nov. 6.	Paoli, Ind.	Oct. 30
Nov. 7.	Mauch Chunk, Pa	Oct. 30
Nov. 8.	Washington, Pa.	Oct. 23
Nov. 8.	Cincinnati, O.	Oct. 23
Nov. 8.	Redding, Cal.	Oct. 23
Nov. 8.	Carman, Man.	Oct. 30
Nov. 9.	Richmond, Ind.	Oct. 23
Nov. 10.	Erie, Kan.	Oct. 30
Nov. 15.	Glendive, Mont.	Oct. 2
Nov. 11.	Whorton, Tex.	Oct. 30
Nov. 12.	Troy, O.	Oct. 16
Nov. 12.	Hamilton, O.	Oct. 30
Nov. 15.	Portland, Ore.	Oct. 23
Nov. 15.	Cincinnati, O.	Oct. 30
Nov. 20.	Georgetown, S. C	Oct. 30
Feb. 13.	St. Charles, Mo	Oct. 30

Buildings.

	Washington, D. C	Oct. 30
Oct. 30.	Terre Haute, Ind	Sept. 18
Oct. 30.	Atlanta, Ga.	Sept. 25
Oct. 30.	Columbus, O.	Oct. 2
Oct. 30.	Dermott, Ark.	Oct. 23
Oct. 31.	Cleveland, O.	Oct. 2
Oct. 31.	Kansas City, Mo	Oct. 9
Oct. 31.	New York, N. Y	Oct. 23
Oct. 31.	New York, N. Y	Oct. 23
Oct. 31.	Denver, Colo.	Oct. 23
Oct. 31.	Chicago, Ill.	Oct. 23
Oct. 31.	Milwaukee, Wis.	Oct. 23
Oct. 31.	Peoria, Ill.	Oct. 23
Oct. 31.	Pittsburg, Pa.	Oct. 30
Nov. 1.	St. Croix Falls, Wis	Oct. 16
Nov. 1.	New Haven, Conn	Oct. 30
Nov. 1.	Port Vue, Pa	Oct. 30
Nov. 1.	Harrisburg, Pa.	Oct. 30
Nov. 2.	Washington, D. C	Oct. 23
Nov. 2.	Villard, N. Dak	Oct. 30
Nov. 4.	Fort Washington, Md	Oct. 9
Nov. 4.	Pierre, S. Dak	Oct. 16
Nov. 4.	Fort Bliss, Tex	Oct. 30
Nov. 4.	Wilkesbarre, Pa.	Oct. 30
Nov. 4.	Richmond, Va.	Oct. 30
Nov. 4.	Philadelphia, Pa.	Oct. 30
Nov. 4.	New York, N. Y	Oct. 30
Nov. 5.	Bloomfield, Ind.	Sept. 18
Nov. 5.	Bloomfield, Ind.	Sept. 25
Nov. 5.	Flint, Mich.	Oct. 2
Nov. 5.	Portland, Me.	Oct. 9
Nov. 5.	New Orleans, La	Oct. 16
Nov. 5.	Los Angeles, Cal	Oct. 23
Nov. 5.	Toronto, Ont.	Oct. 30
Nov. 6.	Luverne, Ala.	Oct. 16
Nov. 6.	Polk, Pa.	Oct. 30
Nov. 6.	McKeesport, Pa.	Oct. 30
Nov. 6.	Chicago, Ill.	Oct. 30
Nov. 6.	Lafayette, Ind.	Oct. 30
Nov. 6.	Chicago, Ill.	Oct. 30
Nov. 7.	National Soldiers Home, Va.,	Oct. 23
Nov. 7.	Fulton, N. Y	Oct. 23
Nov. 8.	Fort Stevens, Ore.	Oct. 23
Nov. 9.	Las Animas, Colo.	Sept. 25
Nov. 11.	Pensacola, Fla.	Oct. 16
Nov. 11.	Cincinnati, O.	Oct. 23
Nov. 11.	Des Moines, Ia	Oct. 23
Nov. 11.	Fort Rosecrans, Cal	Oct. 30
Nov. 11.	Atlantic City, N. J	Oct. 30
Nov. 12.	Pipestone, Minn.	Oct. 16
Nov. 11.	New Orleans, La	Oct. 16
Nov. 12.	Seattle, Wash.	Oct. 16
Nov. 14.	Pine Grove, Pa	Oct. 30
Nov. 15.	Chippewa Falls, Wis	Oct. 9
Nov. 15.	Fort D. A. Russell, Wyo	Oct. 30
Nov. 15.	Superior, Wis.	Oct. 30
Nov 19.	Jefferson Barracks, Mo	Oct. 30
Nov. 20.	Fort Monroe, Va	Oct. 30
Nov. 21.	New Orleans, La	Oct. 9
Nov. 21.	Greenville, Tenn.	Oct. 23
Nov. 22.	Portsmouth, Va.	Oct. 23
Nov. 25.	Tyler, Tex.	Oct. 23
Nov. 29.	Marion, Ind.	Oct. 30
Dec. 3.	Nevada, Mo.	Oct. 30
Dec. 5.	Waldoboro, Me.	Oct. 30

Roads and Streets.

Oct. 30.	Cleveland, O.	Oct. 16
Oct. 30.	Indianapolis, Ind.	Oct. 23
Oct. 30.	Brooklyn, N. Y	Oct. 23
Oct. 30.	Des Moines, Ia	Oct. 23
Oct. 30.	Cleveland, O.	Oct. 23
Oct. 30.	Baltimore, Md.	Oct. 23
Oct. 31.	Fort Logan H. Roots, Ark.	Oct 9
Oct. 31.	Kansas City, Mo	Oct. 23
Oct. 31.	Kansas City, Mo	Oct. 23
Oct. 31.	St. Paul, Minn	Oct. 30
Nov. 1.	Cincinnati, O.	Oct. 23
Nov. 1.	North Braddock, Pa	Oct. 23
Nov. 2.	Greencastle, Ind.	Oct. 23
Nov. 2.	Fort Wayne, Ind	Oct. 23
Nov. 2.	Seattle, Wash.	Oct. 30
Nov. 2.	Monclova, O.	Oct. 30
Nov 4.	Peru, Ind.	Oct. 2
Nov. 4.	Salem, Ind.	Oct. 16
Nov. 4.	Jasper, Ind.	Oct. 16
Nov. 4.	Columbus, Ind.	Oct. 23
Nov. 4.	Sandusky, O.	Oct. 23
Nov. 4.	Red Bank, N. J	Oct. 23
Nov. 4.	Sullivan, Ind.	Oct. 23
Nov. 4.	Logansport, Ind.	Oct. 23
Nov. 4.	Williamsport, Pa.	Oct. 30
Nov. 4.	Lakewood, O.	Oct. 30
Nov. 4.	Syracuse, N. Y	Oct. 30
Nov. 5.	Millvale, Pa.	Oct. 16
Nov. 5.	Paoli, Ind.	Oct. 23
Nov. 5.	Vincennes, Ind.	Oct. 23
Nov. 5.	Brookville, Ind.	Oct. 23
Nov. 5.	Davenport, Ia.	Oct. 30
Nov. 6.	Spokane, Wash.	Oct. 23
Nov. 6.	Brooklyn, N. Y	Oct. 30
Nov. 6.	York, Pa.	Oct. 30
Nov. 6.	Kokomo, Ind.	Oct. 30
Nov. 7.	Rockville, Ind.	Oct. 16
Nov. 7.	New York, N. Y	Oct. 30
Nov. 7.	Kansas City, Mo	Oct. 30
Nov. 7.	Chicago, Ill.	Oct. 30
Nov. 7.	West Seneca, N. Y	Oct. 30
Nov. 7.	Fort Wayne, Ind	Oct. 30
Nov. 9.	Janesville, Wis.	Oct. 23
Nov. 9.	Hobart, Okla.	Oct. 30
Nov. 11.	New York, N. Y	Oct. 30
Nov. 11.	Indianapolis, Ind.	Oct. 30
Nov. 12.	Troy, O.	Oct. 16
Nov. 12.	Denton, Md.	Oct. 30
Nov. 12.	Harrisburg, Pa.	Oct. 23
Nov. 15.	Pensacola, Fla.	Oct. 23
Nov. 18.	Albany, N. Y	Oct. 30
Nov. 21.	Albany, N. Y	Oct. 30
Nov. 25.	Columbia, S. C	Oct. 30
Dec. 6.	Salt Lake City, Utah	Oct. 23
Dec. 13.	Monticello, Ind.	Oct. 30

Sewers.

Oct. 30.	Indianapolis, Ind.	Oct. 23
Oct. 31.	Ardmore, Pa.	Oct. 30
Nov. 1.	North Braddock, Pa	Oct. 23
Nov. 1.	Iowa City, Ia	Oct. 30
Nov. 1.	Riverside, N. J	Oct. 30
Nov. 2.	Seattle, Wash.	Oct. 30
Nov. 3.	Chandler, Okla.	Oct. 30
Nov. 4.	Ottumwa, Ia.	Oct. 23
Nov. 4.	Scranton, Pa.	Oct. 30
Nov. 4.	Milwaukee, Wis.	Oct. 30
Nov. 4.	Two Harbors, Minn	Oct. 30
Nov. 4.	St. Paul, Minn	Oct. 30
Nov. 4.	San Jose, Cal	Oct. 30
Nov. 5.	Millvale, Pa.	Oct. 16
Nov. 5.	Luverne, Minn.	Oct. 23
Nov. 5.	Monroe, Wis.	Oct. 30
Nov. 5.	Olyphant, Pa.	Oct. 30
Nov. 5.	Girard, O.	Oct. 30
Nov. 5.	Trenton, N. J	Oct. 30
Nov. 6.	Brooklyn, N. Y	Oct. 30
Nov. 6.	Chicago, Ill.	Oct. 30
Nov. 6.	Akron, O.	Oct. 30
Nov. 7.	White Plains, N. Y	Oct. 23
Nov. 7.	West Seneca, N. Y	Oct. 30
Nov. 7.	McKeesport, Pa.	Oct. 30
Nov. 7.	St. Paul, Minn	Oct. 30
Nov. 7.	Hattiesburg, Miss.	Oct. 30
Nov. 7.	Fort Wayne, Ind	Oct. 30
Nov. 9.	Hobart, Okla.	Oct. 30
Nov. 9.	Chagrin Falls, O	Oct. 30
Nov. 11.	Seymour, Ind.	Oct. 30
Nov. 11.	North Milwaukee, Wis	Oct. 30
Nov. 11.	New York, N. Y	Oct. 30
Nov. 11.	Indianapolis, Ind.	Oct. 30
Nov. 13.	Reading, Pa.	Oct. 30
Nov. 15.	Boston, Mass.	Oct. 30
Dec. 2.	Cadillac, Mich.	Oct. 23
Dec. 3.	Auburn, N. Y	Oct. 16

Water Supply.

Oct. 30.	Albert Lea, Minn	Oct. 23
Nov. 4.	Tucson, Ariz.	Oct. 2
Nov. 4.	Philadelphia, Pa.	Oct. 30
Nov 5.	New Fort Lyon, Colo	Oct. 9
Nov. 7.	Chilocco, Okla.	Oct. 16
Nov. 9.	Hobart, Okla.	Oct. 30
Nov. 11.	Fort Terry, N. Y	Oct. 23
Nov. 12.	Pipestone, Minn.	Oct. 16
Nov. 14.	Fort Mackenzie, Wyo	Oct. 23
Nov. 15.	Phoenix, Ariz.	Oct. 2
Nov. 12.	Velva, N. Dak	Oct. 30
Dec. 1.	Phoenix, Ariz.	Oct. 16
Dec. 17.	Camden, N. J	Oct. 16

Miscellaneous.

Oct. 30.	New York, N. Y.,	Fireboat Repairs,	Oct. 23
Oct. 31.	Mobile, Ala.,	Snagboat,	Sept. 11
Oct. 31.	New York, N. Y.,	Ferry House,	Oct. 16
Oct. 31.	Boston, Mass.,	Incline,	Oct. 30
Oct. 31.	Washington, D. C.,	Ash Collection,	Oct. 30
Nov. 1.	Harrisburg, Pa.,	Stone Removal,	Oct. 16
Nov. 1.	Fort Schuyler, N. Y.,	Wharf Work,	Oct. 16
Nov. 1.	Calgary, Alberta,	Street Railway,	Oct. 23
Nov. 1.	Chicago, Ill.,	Yard Improvement,	Oct. 30
Nov. 1.	Seattle, Wash.,	Dike Gates,	Oct. 30
Nov. 4.	Louisville, Ky.,	Snagboat Hull,	Oct. 9
Nov. 4.	Fort D. A. Russell, Wyo.,	Steel Fence,	Oct. 16
Nov. 4.	Berrien Springs, Mich.,	Electric Light System,	Oct. 23
Nov. 4.	Ottawa, Ont.,	Pile Work,	Oct. 30
Nov. 4.	La Prairie, Que.,	Ice Piers,	Oct. 30
Nov. 5.	Marion, Ind.,	Electric Plant,	Oct. 30
Nov. 6.	Rye, N. Y.,	Dock,	Oct. 30
Nov. 6.	McKeesport, Pa.,	Iron Fence,	Oct. 30
Nov. 7.	Fort Des Moines, Ia.,	Fence, Etc.,	Oct. 23
Nov. 8.	Kokomo, Ind.,	Electric Lighting,	Oct. 9
Nov. 8.	Kokomo, Ind.,	Electric Plant,	Oct. 16
Nov. 11.	New York, N. Y.,	Towers,	Oct. 30
Nov. 14.	New Orleans, La.,	Monument,	Oct. 16
Nov. 15.	Charleston, S. C.,	Street Lighting,	Sept. 11
Nov. 16.	Charleston, S. C.,	Concrete Pier,	Oct. 23
Nov. 18.	Dallas, Tex.,	Lock and Dam,	Oct. 16
Nov. 20.	New Orleans, La.,	Dredge,	Oct. 2
Nov. 20.	Ludington, Mich.,	Breakwater,	Oct. 30
Nov. 21.	Galveston, Tex.,	Jetty Work,	Oct. 30
Nov. 21.	Austin, Tex.,	Concrete Wall,	Oct. 30
Nov. 21.	Fort Sumter, S. C.,	Wharf,	Oct. 30
Nov. 25.	Mobile, Ala.,	Locks and Dams,	Oct. 2

Excavation, Earth and Rock.

Oct. 31.	Waskom, Tex.,	Railroad Grading,	Oct. 23
Nov. 1.	National Soldiers' Home, Va.,	Dredging,	Oct. 23
Nov. 2.	Tipton, Ind.,	Tile Drain,	Oct. 30
Nov. 4.	Brooklyn, N. Y.,	Seeding, Plowing, Etc.,	Oct. 30
Nov. 6.	Brooklyn, N. Y.,	Dredging,	Oct. 30
Nov. 6.	Brooklyn, N. Y.,	Grading Lot,	Oct. 30
Nov. 6.	Emmetsburg, Ia.	Tile Drain,	Oct. 30

Nov. 7. New Boston, Ill., Ditch and Levee Work, Oct. 16
Nov. 11. Prophetatown, Ill., Ditch Work, Oct. 23
Nov. 12 Pine Bluff, Ark., Levee Work, Oct. 30
Nov. 12. West Point, Miss., Canal, Oct. 30
Nov. 15. Philadelphia, Pa., Dredging, Oct. 23
Nov. 16. Pine Bluff, Ark., Levee Work, Oct. 23
Nov. 19. Fort Dodge, Ia., Drainage, Oct. 30
Nov. 20. Detroit, Mich., Dredging, Oct. 16
Nov. 20. Grand Rapids, Mich., Dredging, Oct. 30
Nov. 21. Galveston, Tex., Dredging, Oct. 30
Nov. 21. Mobile, Ala., Dredging, Oct. 30
Nov. 22. Newport, R. I., Dredging, Oct. 30
Nov. 25. Memphis, Tenn., Levee and Ditch, Oct. 30
Nov. 25. New York, N. Y., Dredging, Oct. 30

Materials, Machines, Supplies, Tools, Etc.

Oct. 30. Bay City, Mich., Steam Turbine, Boilers, Etc., Oct. 23
Oct. 30. Baltimore, Md., Motor, Oct. 23
Oct. 31. Cleveland, O., Mechanical Equipment, Oct. 2
Oct. 31. New York, N. Y., Mechanical Equipment, Oct. 30
Nov. 1. Calgary, Alberta, Street Cars, Oct. 23
Nov. 1. Augusta, Ga., Rails, Ties, Etc., Oct. 23
Nov. 4. Washington, D. C., Tanks, Meters, Etc., Oct. 9
Nov. 4. Washington, D. C., Tools, Meters, Etc., Oct. 9
Nov. 4. Philadelphia, Pa., Pump, Pipe, Oct. 30
Nov. 4. New Orleans, La., Fire Hose, Oct. 30
Nov. 4. Milwaukee, Wis., Boilers, Oct. 30
Nov. 5. Oceanside, Cal., Pumping Engine, Boiler, Oct. 23
Nov. 5. Millvale, Pa., Truck, Oct. 23
Nov. 5. Milwaukee, Wis., Crushed Stone, Screenings, Oct. 30
Nov. 6. McKeesport, Pa., Fire Alarm System, Oct. 30
Nov. 7. New York, N. Y., Road Rollers, Oct. 30
Nov. 8. Washington, D. C., Pumps, Cement, Etc., Oct. 16
Nov. 11. Fort Totten, N. Y., Torpedo Cases, Oct. 30
Nov. 12. Washington, D. C., Cars, Jacks, Tile, Etc., Oct. 23
Nov. 12. Key West, Fla., Boiler, Oct. 23
Nov. 12. Kansas City, Mo., Vault Equipment, Oct. 30
Nov. 14. Fort Morgan, Ala., Pumping Plant, Oct. 23
Nov. 15. Winnipeg, Man., Water Pipe, Oct. 9
Nov. 16. New Fort Lyon, Colo., Laundry Equipment, Oct. 30
Nov. 16. Washington, D. C., Laundry Equipment, Oct. 30
Nov. 18. Portland, Ore., Hoisting Engines, Etc., Oct. 23
Nov. 19. Washington, D. C., Car Wheels, Conduit, Etc., Oct. 30
Nov. 25. Atlanta, Ga., Pump, Pipe, Engine, Oct. 30
Dec. 1. Phoenix, Ariz., Water Pipe, Oct. 16
Jan. 15. Manila, P. I., Pumps and Motors, Oct. 30

BIDS ASKED.

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Sacramento, Cal.—Until Nov. 4, by County Supervisors, for strengthening piers and construction of an abutment to 12th St. bridge over the American River. Bids are also asked for reconstruction of long trestle north of the bridge.

Crown Point, Ind.—Until Nov. 4, by Chas. A. Johnson, County Auditor, for construction of iron bridge in Calumet Township.

Huntington, Ind.—Until Nov. 4, by M. A. Sweeney, County Auditor, for constructing steel bridge over Patoka River on Jasper and Huntingburg Road.

Paoli, Ind.—Until Nov. 6, by J. E. Davis, County Auditor, for constructing bridge at Black Mills and bridge at Granville.

Erie, Kan.—All bids received by County Commissioners for building three bridges—one east of Chanute, one west of Erie and one south of St. Paul—were rejected and new bids are bing asked to be opened about Nov. 10. An appropriation of $24,000 is available for the construction of the three bridges.

Wichita, Kan.—Until Nov. 4, by R. N. Dorr, City Clerk, for construction of concrete arch bridge over Wichita Drainage Canal.

Wichita, Kan.—Until noon, Nov. 4, by C. N. Cartwright, County Clerk, for constructing following bridges: Pile bridge over Dry Creek, 46 ft. long and 16 ft. wide; steel bridge over Cowskin Creek, 80 ft. long, 16 ft. wide; steel bridge over the west branch of the Arkansas River, 70 ft. long and 16 ft. wide; steel bridge over Prairie Creek, 60 ft. long and 16 ft. wide; steel bridge over Chisholm Creek, 40 ft. long and 16 ft. wide; steel bridge over Spring Creek, 30 ft. long and 16 ft. wide.

Greenville, Miss.—Until noon, Nov. 4, by T. H. Hood, Clerk, County Supervisors, for construction of bridge over Six Mile Bayou.

St. Charles, Mo.—Until Feb. 13, by County Commissioners for constructing Cuivre River bridge at Old Monroe. Bridge is to cost about $8,000.

Washington, N. C.—Until Nov. 4, by Gilbert Rumley, Clerk County Commissioners, for construction of two bridges.

Cincinnati, O.—Until Nov. 15, by County Commissioners for repair of bridge over Big Miami River.

Hamilton, O.—Until Nov. 12, by Chris Pabst, County Auditor, for construction of concrete substructure of bridge over Two-Mile Creek on Seven Mile Pike.

Lancaster, Pa.—Until noon, Nov. 4, by M. G. Schaeffer, County Controller, for repairing bridges and for masonry work.

Indiana, Pa.—Until Nov. 1, by County Commissioners, for construction of two steel bridges, 30 ft. and 34 ft. spans.

Mauch Chunk, Pa.—Until Nov. 7, by County Commissioners, for constructing new span to replace eastern span on East Mauch Chunk bridge over Lehigh River.

Waco, Tex.—Until 10 a. m., Nov. 1, by W. C. M'Collum, County Auditor, for erection of five steel bridges.

Georgetown, S. C.—Until Nov. 20, by J. B. Johnson, County Supervisor, for constructing steel drawbridge over Mingo Creek.

Wharton, Tex.—Until noon, Nov. 11, by G. S. Gordon, County Judge, for erection of steel highway bridge over San Bernard River, at point where it is 325 ft. wide. H. Pennington, Engineer, 52 Theater Bldg., Houston, Tex.

Sundance, Wyo.—Until noon, Nov. 5, by M. L. Nauch, County Clerk, for construction of two steel bridges over Belle Fourche River.

Carman, Man., Canada.—Until noon, Nov. 8, by A. Malcolmson, Secretary-Treasurer, for 90 ft. span Pratt truss steel bridge, with 18 ft. roadway, and concrete abutments, to be built over the Boyne River.

Winnipeg, Man.—Until noon, Nov. 1, by M. Peterson, Secy. Board of Control, for furnishing city with one second-hand, single-track, through-truss, steel railway bridge, 155 ft. to 165 ft. single span.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Rosecrans, Cal.—Until noon, Nov. 11, by Lieut. B. H. L. Williams, Constructing Q. M., for construction of a frame boat house for submarine mine boats.

New Haven, Conn.—Until Nov. 1, by Board of Education, for erection of public school building on Greens St.

Washington, D. C.—Executive Committee of Carnegie Institution, Robert S. Woodward, President, Bond Bldg., has rejected all bids for construction of new administration building to be erected at 16th and P Sts., and will receive new bids. The building will cost about $200,000. Carrere & Hastings, 5th Ave. and 26th St., New York City, are the Architects.

Chicago, Ill.—Until 11 a. m., Nov. 6, by Department of Public Works, 322 City Hall, for constructing 2-story and basement brick and stone fire engine house at 87th and Escanaba Ave.

Chicago, Ill.—Until 3 p. m., Nov. 6, by James Knox Taylor, Supervising Architect, Washington, D. C., for painting at the U. S. Post Office, Court House, etc., at Chicago, Ill.

Lafayette, Ind.—Until Nov. 6, by Trustees State Soldiers' Home, Lafayette, for remodeling the old hospital building to be converted into a convalescent home.

Marion, Ind.—Until 3 p. m., Nov. 29, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Marion, Ind.

Waldoboro, Me.—Until 3 p. m., Dec. 5, by James Knox Taylor, Supervising Architect, Washington, D. C., for construction (except plumbing, electric wiring and conduits) of the extension to the U. S. Post Office and Custom House, Waldoboro.

Jefferson Barracks, Mo.—Until 11 a. m., Nov. 19, by O. W. Bell, Q. M., for construction of two barrack buildings, including heating, plumbing, electric wiring and disinfecting plant.

Nevada, Mo.—Until 3 p. m., Dec. 3, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Nevada.

Atlantic City, N. J.—Until 8 p. m., Nov. 11, by Council Committee on Streets, Walks and Drives, for construction of reinforced concrete rest pavilion and comfort station. Plans, etc., with H. A. Stout, Arch., 600 Bartlett Bldg., Atlantic City, N. J.

New York, N. Y.—Until 11 a. m., Nov. 4, by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., for installing heating and ventilating apparatus in addition to Public School 29. Security required is $2,000.

Villard, N. Dak.—Until 2 p. m., Nov. 2, by S. M. Koto, Clerk, Wintering School District, for construction of three frame school houses.

Pittsburg, Pa.—Until 10:30 a. m., Oct. 31, by J. P. Shaw, Director of Charities, for erection of a kitchen and repairing of the chapel building tor the department of charities and corrections at Marshalsea Station, P. C. & St. L. R. R.

Pine Grove, Pa.—Until Nov. 14, by State Armory Board, Harrisburg, Pa., for constructing armory at this place.

Harrisburg, Pa.—Until noon, Oct. 1, by County Commissioners, for wiring Dauphin County Almshouse.

McKeesport, Pa.—Until 4 p. m., Nov. 6, by C. E. Soles, City Controller, for four cells for police station.

Philadelphia, Pa.—Until noon, Nov. 4, by Geo. R. Stearns, Director Public Works, for work under Specifications No. 89—Corrugated iron roof covering for ventilators of boiler house, Spring Garden Pumping Station.

Polk, Pa.—Until 2:30 p. m., Nov. 6 (readvertisement), by State Hospital Board. Harrisburg, for constructing 6 buildings at Polk. John A. Wiley, Secy., Franklin, Pa.

Port Vue, Pa.—Until 4 p. m., Nov. 1, by Board of Education, for constructing school house. W. F. Wilson, McKeesport, Pa., is Architect.

Wilkesbarre, Pa.—Until Nov. 4, by J. M. Norris, County Controller, for constructing wall and boiler house at prison.

Fort Bliss, Tex.—Until noon, Nov. 4, by Constructing Q. M., for alterations in two lavatory buildings at this post. Alterations consist of removing present fixtures, relaying concrete floors and furnishing and installing plumbing and heating fixtures.

Fort Monroe, Va.—Until noon, Nov. 20, by Capt. Ernest R. Tilton, Constructing Q. M., for 25 bathrooms, at Fort Monroe, Va., including construction and plumbing repairs.

Richmond, Va.—Until noon, Nov. 4, by Capt. Wm. M. Myers, 731 E. Main St., for remodeling and building extension to the Howitzers' Armory building, on North Seventh St. C. K. Howell, Architect; 729 East Main St.

Superior, Wis.—Until Nov. 15, by Board of Regents of Normal Schools, State Capitol, Madison, for erection of addition to state normal school building in this city.

Fort D. A. Russell, Wyo.—Until 10:30 a. m., Nov. 15, by Capt. V. K. Hart, Constructing Q. M., Cheyenne, for furnishing all material and labor required and installing a heating plant in new hospital, now under construction at Fort D. A. Russell.

Toronto, Ont.—Until Nov. 5, by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont., for alterations and additions to Post Office building at Toronto.

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Chicago, Ill.—Until 10:15 a. m., Nov. 7, by O. E. Chapin, Secy. Bd. Local Improvements, City Hall, for seven contracts for constructing cement sidewalks.

Fort Wayne, Ind.—Until 7:30 p. m., Nov. 7, by H. W. Becker, Clerk Bd. Pub. Wks., for grading Short St.

Kokomo, Ind.—Until 2 p. m., Nov. 6, by William L. Benson, County Auditor, for the construction of eleven gravel roads—seven in Howard Township, three in Clay Township, and one in Ervin Township.

Monticello, Ind.—Until noon, Dec. 13, by J. C. Ackerman, County Auditor, for the grading, draining, and paving with gravel, the Kelley road, in Prairie Township; also for the grading, draining and paving with broken stone, the Personett road in Jackson Township.

Indianapolis, Ind.—Until 10 a. m., Nov. 11, by Board Public Works, for improvement of Irvington Ave., by grading and paving sidewalks with cement; also for improvement of Wilson St., by grading, graveling and rolling the roadway.

Davenport, Ia.—Until 2 p. m., Nov. 5, by Board Public Works, Thos. Murray, City Engineer, for paving alley, work requiring 220 cu. yds. excavation and 718 sq. yds. brick paving.

Denton, Md.—Until noon, Nov. 12, by S. L. Dukes, Clerk County Commissioners, for grading and macadamizing one mile of the Denton Three Bridges Road.

St. Paul, Minn.—Until 2 p. m., Oct. 31, by R. L. Gorman, Clk. Bd. Pub. Wks., for grading Topping St., from Hamline Ave. to Syndicate Ave.

Kansas City, Mo.—Until 11 a. m., Nov. 7, by E. A. Harper, City Engineer, for constructing artificial stone curb on portions of 7 streets.

Albany, N. Y.—Until Nov. 18 and Nov. 21, by Frederick W. Skene, State Engineer, for the construction of 56 macadam roads, aggregating about 240 miles.

Brooklyn, N. Y.—Until 11 a. m., Nov. 6, by Bird S. Coler, Borough President, for six contracts for regulating and repaving with asphalt pavement, one contract for regulating and repaving with asphalt block pavement, four contracts for regulating and repaving with wood block pavement, and three contracts for regulating, grading, curbing and laying sidewalks.

Syracuse, N. Y.—Until 1:30 p. m., Nov. 4, by George J. Metz, City Clerk, for 8 contracts for constructing sidewalks.

West Senaca, N. Y.—Until 4 p. m., Nov. 7, (extension of date), by Joseph Waldraff, Town Clerk, for macadamizing and improving Steelawanna Ave., Wilkesbarre Ave., Lebanon St. and Bethlehem St.

New York, N. Y.—Until 2 p. m., Nov. 7, by Henry S. Thompson, Commissioner Pub. Wks., 13 Park Row, for the work under 7 contracts for regulating and repaving with asphalt blocks, for the work under 14 contracts for regulating and repaving with asphalt, for work under 3 contracts for regulating and repaving with granite blocks, one contract for regulating and repaving with wood blocks; also for 3 contracts for regulating, grading, curbing and flagging.

New York, N. Y.—Until 11 a. m., Nov. 11, by Joseph Bermel, President Queens Borough, Long Island City, for constructing 3,565 sq. yds. asphalt block pavement on Onderdonk Ave., and 3,300 sq. yds. of asphalt block pavement on Academy St.

Monclova, O.—Until noon, Nov. 2, by Don C. Whitehead, Township Clerk, for draining, grading and macadamizing ½ mile of county road.

Lakewood, O.—Until 11 a. m., Nov. 4, by B. M. Cook, Village Clerk, for paving Newman Ave.

Hobart, Okla.—Until 8 p. m., Nov. 9, by A. W. Kerr, City Clerk, for grading, curbing and paving certain streets, the work including the following: Paving—41,700 sq. yds. (brick, bitulithic or asphalt); curbing—8,600 lin. ft. (stone or concrete); headers—4,000 lin. ft. O. S. Noble, City Engineer.

Williamsport, Pa.—Until noon, Nov. 4, by James F. Fisher, City Engineer, for grading W. 3rd St.

York, Pa.—Until 7:30 p. m., Nov. 6, by Board of Works, for paving an alley.

Columbia, S. C.—Until noon, Nov. 25, by Chas. Narey, Chairman Street Commission, for paving Main St. with either vitrified brick, wood block, asphalt or bitulithic. Work includes 65,000 sq. yds. of pavement, 17,000 lin. ft. combined curb and gutter, and 4,500 lin. ft. of concrete storm drains. J. L. Ludlow, Engineer, Winston-Salem, N. C. The official advertisement will be found elsewhere in this issue.

Seattle, Wash.—Until Nov. 2, by C. B. Bagley, Secy. Bd. Pub. Wks., for grading, curbing and constructing concrete sidewalks on a number of streets.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

San Jose, Cal.—Until 3 p. m., Nov. 4, for labor and material for constructing 9,932 ft. of 24in.x36in. ovel concrete intercepting sewer. Alternate bids will be received on a round 33 in. reinforced concrete sewer. Chas. H. Pieper, City Engineer.

Iowa City, Ia.—Until 2 p. m., Nov. 1, by O. J. Slater, City Clerk, for construction of 1,400 ft. of 18 in. vitrified pipe sewer.

Chicago, Ill.—Until 10:15 a. m., Nov. 6, by O. E. Chapin, Secy. Bd. Local Improvements, City Hall, for 13 contracts for constructing tile pipe sewers.

Indianapolis, Ind.—Until 10 a. m., Nov. 11, by Board Public Works, for construction of local sewer in alley; also local sewer in Washington Boulevard.

Fort Wayne, Ind.—Until 7:30 p. m., Nov. 7, by H. W. Becker, Clerk Bd. Pub. Wks., for constructing vitrified clay pipe sewer in alley between Huestia Ave. and Grace Ave.

Seymour, Ind.—Until 8 p. m., Nov. 11, by Fred Everback, City Clerk, for construction of a 10 in. sewer; also a 15 in. sewer.

Boston, Mass.—Until 2:30 p. m., Nov. 15, by Metropolitan Water and Sewerage Board, 1 Ashburton Pl., Boston, for constructing in rock and earth trench and tunnel Section 81 and parts of Sections 83 and 85 of the Extension of the High Level Sewer, South Metropolitan System, in Brookline and Brighton. The work includes the following: Contract No. 60, 2,140 ft. 78-in.x84-in. concrete sewer in trench; Contract No. 61, 920 ft. 78-in.x84-in. sewer in rock and earth tunnel and 355 ft. in trench; Contract No. 62, 1,664 ft. 69-in.x72-in., in earth tunnel; Contract No. 63, 1,252 ft. 69-in.x72-in., in rock tunnel; Contract No. 64, 2,300 ft. 69-inx72-in., in rock tunnel; Contract No. 65, 1,650 ft. 69-inx72-in., in rock and earth tunnel.

St. Paul, Minn.—Until 2 p. m., Nov. 7, by R. L. Gorman, Clk. Bd. Pub. Wks., for sewer in St. Anthony and Wilder Aves.

St. Paul, Minn.—Until 2 p. m., Nov. 4, by R. L. Gorman, Clerk Bd. Pub. Wks., for constructing sewers on Cook St., Cortland Ave. and Magnolia St.

Two Harbors, Minn.—Until Nov. 4, by City Clerk, for constructing 2,560 ft. of sanitary sewer in 7th Ave.

Hattiesburg, Miss.—Until 8 p. m., Nov. 7 (Readvertisement), by J. H. Putnam, City Engineer, for constructing sanitary sewers. The work includes: 2,640 lin. ft., 15-in. sewer; 2,090 lin. ft. 12-in. sewer; 8,550 lin. ft. 10-in. sewer; 15,150 lin. ft. 8-in. sewer; 90 manholes; 7 flush tanks; 20 cu. yds. concrete masonry; 900 cu. yds. excavation; 140,000 ft. B. M. sheeting left in trench; 45,000 ft. B. M. foundation lumber.

Trenton, N. J.—Until 8 p. m., Nov. 5, by Harry B. Salter, City Clerk, for construction of sewer in Hamilton Ave., Fairmount Ave., and Liberty St.

Riverside, N. J.—Until 8 p. m., Nov. 1, by Irven Kollo, Township Clerk, for constructing sewer system, consisting of 10 miles of 8-in. to 24-in. sewers, pump house, engines, pump, pump-well and disposal works. Wm. H. Boardman, Engineer.

Brooklyn, N. Y.—Until 11 a. m., Nov. 6, by Bird S. Coler, Borough President, for work under 6 contracts for constructing sewers. Estimated cost of largest contract is $3,328.

New York, N. Y.—Until 11 a. m., Nov. 11, by Joseph Bermel, President Queens Borough, Long Island City, for constructing 945 lin. ft. 12 in. and 990 lin. ft. 6 in. pipe sewer.

Girard, O.—Until Nov. 5, by E. L. Hauser, Village Clerk, for constructing 5,600 lin. ft. of 18 in. pipes sewer.

West Seneca, N. Y.—Until 4 p. m., Nov. 7 (extension of date), by Joseph Waldraff, Town Clerk, for constructing sewer in Bethlehem St.; also for sewer in Lebanon St.

Akron, O.—Until noon, Nov. 6, by Chas. H. Watters, Secy. Bd. Pub. Service, for constructing sewers in Halstad St., Nathan St., Kling St., Crozier St., Berry Ave. and Bloomfield Ave.

Chagrin Falls, O.—Until noon, Nov. 9, by H. D. Bishop, Village Clerk, for the construction of the sewage purification plant, including septic tank, contact filters, sand filters, automatic controlling device, together with all necessary grading and pipe connections within the limits of the purification plant grounds. Also for the construction of all sewers in the sewerage system, together with all manholes, flushing tanks and other appurtenances. Walter P. Rice Engineering Co., Engineers, 629 Society fur Savings Bldg., Cleveland, O.

Chandler, Okla.—Until 10 a. m., Nov. 3, by J. E. Rea, County Clerk, for installation of septic tank of 25,000 gallons capacity in 12 hours for sewage disposal; also for laying about 1,200 ft. of sewer.

Hobart, Okla.—Until 8 p. m., Nov. 9, by A. W. Kerr, City Clerk, for labor and material for constructing complete system of storm water sewers, the work including: 585 ft. 48-in. sewer; 820 ft. 42-in. sewer; 490 ft. 36-in. sewer; and 476 ft. 30-in. sewer (concrete or brick); 476 ft. 21-in. sewer concrete, brick or pipe); 772 ft. 18-in. sewer (concrete, brick or pipe); 2,085 ft. 15-in. sewer pipe; 420 ft. 12-in. sewer pipe; 1,625 ft. 10-in. sewer pipe; 16 manholes; 34 catchbasins. O. S. Noble, City Engineer.

McKeesport, Pa.—Until 4 p. m., Nov. 7, by C. E. Soles, City Controller, for constructing 18-in. sewer.

Olyphant, Pa.—Until Nov. 5, by L. Blockberger, Secy., for constructing sewer system. A. B. Dunning, Scranton, Pa., is Engineer.

Scranton, Pa.—Until 10:30 a. m., Nov. 4, by C. R. Acker, Director Public Works, for constructing sewers in Sec. C, 10th District; also for sewer in Forest Court.

Seattle, Wash.—Until Nov. 2, by C. B. Bagley, Secy. Bd. Pub. Wks., for constructing sewer in 11th Ward.

Ardmore, Pa.—Until Oct. 31, by R. A. Warner, Supt. of Drainage, Box 708, for construction of 1,575 ft. of 8 in. sewer.

Reading, Pa.—Until Nov. 13, by City Controller, for constructing three storm sewers. Elmer E. Beard, City Engineer.

Milwaukee, Wis.—Until 10:30 a. m., Nov. 4, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for constructing pipe sewer in Hill Pl., in Estes St., and in American Ave.

Monroe, Wis.—Until 6 p. m., Nov. 5, by M. T. Gettigs, City Clerk, for construction of 800 lin. ft of 5-in. sewer.

North Milwaukee, Wis.—Until 7:30 p. m., Nov. 11, by E. H. Klamp, Village Clerk, for material and labor for construction of septic tank of concrete, 42 ft. in diameter by 16 ft. deep, with brick power house, 18 ft. in diameter by 10 ft. high, erected above it. W. G. Kirchoffer, Engineer, Madison, Wis. The official advertisement will be found elsewhere in this issue.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Velva, N. Dak.—Until 2 p. m., Nov. 12, by this city for a complete water works system, consisting of an 85,000 gallon concrete reservoir, sewer tile gravity pipe line, cast iron pressure distribution pipe lines, frame pumping station, combined gasoline engine and pump and two intake wells. Oscar Claussen, Consulting Engineer, 514 German Am. Bank Bldg., St. Paul, Minn.

Hobart, Okla.—Until 8 p. m., Nov. 9, by A. W. Kerr, City Clerk, for material and labor for extending the water mains, the work including: 18,000 ft. 4-in. c. i. pipe; 5,500 ft. 6-in. c. i. pipe; 38 fire hydrants; 4 6-in. valves; 11 4-in. valves. O. S. Noble, City Engineer.

Philadelphia, Pa.—Until noon, Nov. 4, by Geo. R. Stearns, Director Public Works, for the following: Specification No. 94. For excavating water pipe trenches for high pressure fire main system; specification No. 95, for excavating water pipe trenches and laying cast-iron water pipe and all appurtenances for high pressure fire main system. Information may be obtained from the Chief of the Bureau of Water, 790 City Hall.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

Mobile, Ala.—Dredging.—Until 11 a. m., Nov. 21, by Major H. Jervey, U. S. Engrs., for dredging at the mouths of Wolf and Jordan, rivers, Mississippi.

Pine Bluff, Ark.—Until 1 p. m., Nov. 12, by Benjamin Franklin, Chairman Board of Inspectors of Levee District No. 2, for labor and material and constructing a line of levee from a point on Clayton levee east to Noble lake, thence around Old River, to a point north of Fairfield, Ark. The amount of embankment is approximately 150,000 cu. yds. Chas. E. Moore, Engineer, Pine Bluff.

Emmetsburg, Ia.—Tile Drain.—Until Nov. 6, by Sim R. Stedman, County Auditor, for material and labor for laying 1,170 ft. of 8 in. tile.

Fort Dodge, Ia.—Drainage.—Until Nov. 19, by County Auditor, for constructing drainage works in Drainage District No. 30. C. Anderson, Lake City, Ia., is Engineer.

Tipton, Ind.—Tile Drain.—Until 1 p. m., Nov. 2, by Commissioners of Tipton County, at Tipton, for the construction of about two miles of tile ditch ranging from 8 to 16 ins. P. O. Duncan, County Engineer.

Grand Rapids, Mich.—Dredging.—Until 3 p. m., Nov. 20, by Col. M. B. Adams, U. S. Engrs., 57 Park St., Grand Rapids, Mich., for dredging at Muskegon Harbor, Mich.

West Point, Miss.—Canal.—Until Nov. 12, by Clay County Houlka Drainage Commissioners, for cutting a canal 12 miles long through Houlka creek bottom. Canal to be 20 ft. wide at top, 16 ft. at bottom one-half distance; 25 ft. at top, 20 ft. at bottom the balance; all 5 ft. deep. Dirt to be thrown 10 ft. clear of banks on each side and berm cleared of stumps. Right of way cleared of timber 30 ft. from center of ditch. 238,000 cu. yds. of dirt to be excavated. Soil black loam in flat creek bottom. No quicksand. Eighty-five per cent paid each mile or month of work. For further information write Ben H. McFarland, Secretary, Aberdeen, Miss.

Brooklyn, N. Y.—Seeding, Plowing, Etc.—Until 11 a. m., Nov. 4, by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., New York, for seeding, plowing, fertilizing, etc., of athletic field between Avenues L and K, and E. 17th St., and Brighton Beach R. R., Flatbush. Security required is $1,000.

Brooklyn, N. Y.—Dredging.—Until 11 a. m., Nov. 6, by Bird S. Coler, Borough President, for about 14,500 cu. yds. of dredging in Newton Creek Canal.

Brooklyn, N. Y.—Grading Lot.—Until 11 a. m., Nov. 6, by Bird S. Coler, Borough President, for grading lot at northwest corner of 45th St. and 7th Ave., requiring 3,686 cu. yds. earth excavation.

New York, N. Y.—Dredging.—Until noon, Nov. 25, by Col. John G. D. Knight, U. S. Engrs., Room F7 Army Bldg., New York, for dredging in Mattituck Harbor, N. Y.

Newport, R. I.—Dredging.—Until 11 a. m., Nov. 22, by Lt. Col. J. H. Willard, U. S. Engrs., for dredging at Newport Harbor, R. I.

Memphis, Tenn.—Levee and Ditch.—Until noon, Nov. 25, by Capt. Wm. D. Connor, U. S. Engrs., Room 20, Custom House, Memphis, for about 190,000 cu. yds. of levee work and 40,000 cu. yds. of drainage ditch in upper St. Francis Levee District.

Galveston, Tex.—Dredging.—Until noon, Nov. 21, by Capt. John C. Oakes, U. S. Engrs., for dredging through Turtle Cave between Aransas Pass and Corpus Christi Bay.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Ash Collection.—Until noon, Oct. 31, by Jay J. Morrow, Engineer, Commission, for collection and disposal of ashes from private residences, apartment houses with not to exceed four families, and boarding houses and lodging houses with not to exceed 25 rooms in the District of Columbia for the period from Nov. 1, 1907, to June 30, 1910.

Marion, Ind.—Electric Plant.—Until Nov. 5, by County Commissioners, for construction of electric light building at County Infirmary.

Chicago, Ill.—Yard Improvements.—Until noon, Nov. 1, by Board of Education, 730 Tribune Bldg., for yard improvements at Englewood High School.

Boston, Mass.—Incline.—Until noon, Oct. 31, by B. Leighton Beal, Secy. Boston Transit Commission, for constructing open incline for Washington St. tunnel north of Boston City Hospital Relief Station, near Canal St.

Ludington, Mich.—Breakwaters.—Until 3 p. m., Nov. 20, by Col. M. B. Adams, U. S. Engrs., 57 Park St., Grand Rapids, Mich., for construction of breakwaters at Ludington.

New York, N. Y.—Towers.—Until 11 a. m., Nov. 11, by Joseph Bermel, President Queens Borough, Long Island City, for furnishing the necessary materials and erecting three signal towers for triangulation in the Borough of Queens. Security required is $500.

Rye, N. Y.—Dock.—Until Nov. 6, by George L. Henderson, Village Clerk, for constructing dock on bulkhead at Milton. Charles S. Towle, Engineer, 5 E. 42nd St., New York City.

McKeesport, Pa.—Iron Fence.—Until 4 p. m., Nov. 6, by C. E. Soles, City Controller, for constructing iron fence.

Austin, Tex.—Concrete Wall.—Until Nov. 21, by C. E. Leonard, City Engineer, according to reports, for constructing concrete retaining wall and abutment containing 1,324 cu. yds. of concrete. Estimated cost is $8,000.

Fort Sumter, S. C.—Wharf.—Until 11:30 a. m., Nov. 21, by J. M. Fulton, Q. M., Fort Moultrie, S. C., for construction of wharf at Fort Sumter.

Galveston, Tex.—Jetty Work.—Until noon, Nov. 21, by Capt. John C. Oakes, U. S. Engrs., for jetty work at Aransas Pass, Tex.

Seattle, Wash.—Dike Gates.—Until Nov. 1, by the Pacific Coast Dyking Co., 304 Pioneer bldg., for the construction of the dyke and tide gates in South Bay, Grays Harbor.

La Prairie, Que.—Ice Piers.—Until Nov. 4, by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing two ice piers in River St. Jacques at La Prairie.

Ottawa, Ont.—Pile Work.—Until Nov. 4, by Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, for construction of pile protection work at McGregor's Creek, near Chatham.

Materials, Machines, Supplies, Tools Etc

Bids are asked on following work, the notes being arranged alphabetically by states:

New Fort Lyon, Colo.—Laundry Equipment.—Until 11 a. m., Nov. 16, by Bureau of Yards and Docks, Navy Department, Washington, until 11 a. m., Nov. 18, for furnishing and installing laundry equipment in the naval hospital, New Fort Lyon, Colo.

Washington, D. C.—Car Wheels, Conduit, Etc.—Until 10:30 a. m., Nov. 19, by H. F. Hodges, General Purchasing Officer Isthmian Canal Commission, for furnishing car wheels, wrought iron, steel tubing, electrical fixtures, conductor wire, iron conduit, etc.

Washington, D. C.—Laundry Equipment.—Until 11 a. m., Nov. 16, by Bureau Yards and Docks, for furnishing and installing laundry equipment at the Naval Hospital Medical School, Washington, D. C.

Atlanta, Ga.—Pump, Pipe, Engine.—Until 3 p. m., Nov. 25, by F. P. Rice, Chairman Joint Council Committee, for furnishing city with a 20-million and a 25-million gallon centrifugal pumps; also for furnishing a vertical triple expansion high duty pumping engine of 20 million gallons capacity per 24 hours. Bids are also asked for furnishing 13,000 ft. of 36-in. water pipe.

New Orleans, La.—Fire Hose.—Until noon, Nov. 4, by Jno. B. Sheehan, Secy. Fire Commissioners, for furnishing 5,000 ft. first quality cotton, rubber lined 2½-in. hose, coupled complete.

Kansas City, Mo.—Vault Equipment—Until 2 p. m., Nov. 12, by Everett Elliott, Secy. Bd. Pub. Wks., for furnishing metallic equipment for vault in City Clerk's office.

Fort Totten, N. Y.—Torpedo Cases.—Until noon, Nov. 11, by the Disbursing Office, Torpedo Department, Fort Totten, for steel submarine torpedo cases.

New York, N. Y.—Road Rollers.—Until 3 p. m., Nov. 7, by Park Board, for furnishing and delivering two 12-ton, 3-wheel steam road rollers for Department of Parks, Bronx Borough. Blanks at office of Department of Parks, Zbrowski Mansion, Claremont Park, The Bronx.

New York, N. Y.—Mechanical Equipment.—Until 2:30 p. m., Oct. 31, by Robert Watchorn, Commissioner of Immigration, Ellis Island, N. Y. H., for mechanical equipment of Measles Wards C, D and G, Isolation Ward L, Staff House and Mortuary, Contagious Disease Hospital Group, U. S. Immigrant Station, Ellis Island.

McKeesport, Pa.—Fire Alarm System.—Until 4 p. m., Nov. 6, by C. E. Soles, City Controller, for underground fire and police alarm system.

Philadelphia, Pa.—Pump, Pipe.—Until noon, Nov. 4, by Geo. R. Stearns, Director Public Works, for the following: Specification No. 90. For one 6,000,000 gallon pumping engine for Belmont High Service Pumping Station; specification No. 93, for furnishing pipe fittings and materials for high pressure fire main system. Information may be obtained from Chief of Bureau of Water, 790 City Hall.

Manila, P. I.—Pumps and Motors.—Until noon, Jan. 15, by Municipal Board, Jno. M. Tuther, Secy., for furnishing and installing 12 pumps and motors for new sewer system. Plans, etc., from Mr. Tuther or from Bureau of Insular Affairs, Washington, D. C.

Milwaukee, Wis.—Crushed Stone Screenings—Until 10:30 a. m., Nov. 5, by Charles J. Poetsch, Chairman Bd. Pub. Wks., for furnishing $7,300 worth of crushed stone and $1,500 worth of stone screenings.

Milwaukee, Wis.—Boilers.—Until 10:30 a. m., Nov. 4, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for constructing, delivering and erecting three return tubular boilers for North Point pumping station.

CONTRACTS LET.

The following contracts have been let recently:

San Bernardino, Cal.—Shops, Round House.—Carl Leonardt, Los Angeles, Cal., for new 100x500 ft. machine shops for Santa Fe Ry.; also for 35-stall round house to cost $150,000.

Napa, Cal.—Bridge.—H. W. Wing, at $6,680, for stone masonry bridge over Milliken Creek.

San Diego, Cal.—Bridge.—Charles Stessgen, at $2,485, for wooden bridge over Penasquitas Creek.

Palatka, Fla.—Bridge.—Converse Bridge Co., Chattanooga, Tenn., at $54,000, for construction of county highway bridge over St. Johns River.

Rathdrum, Idaho. — Bridge. — Carscallen Bros., Coeur d'Alene, Idaho, at $5,250, for steel bridge over Spokane River at Huetter.

Albia, Ia.—Water Main.—Gary P. Combs, for extension of Jefferson St. water mains.

Dubuque, Ia.—Paving.—McCarthy Construction Co., Davenport, Ia., for paving Windsor Ave.

North Chicago, Ill.—Sewers.—H. D. Hallett, Aurora, Ill., at $60,000, for building sewers at naval training school, North Chicago.

Duquoin, Ill.—Water Mains.—Wm. Tunny, Joliet, Ill., for constructing water main system.

Evansville, Ind.—Sewer.—Frank Neglar, for construction of Maryland St. sewer.

Indianapolis, Ind.—Roadwork.—J. H. Roberts, for improvement of Randolph St., with gravel roadway, cement walks, and curb; American Construction Co., for improvement of first alley south of Henry St., with brick roadway; Marion County Construction Co., for improvement of Maryland st. with brick roadway; Geo. W. McCray, for improvement of first alley north of 15th St., with brick roadway.

Princeton, Ind.—Gas Plant.—William Tolle, for constructing gas plant for Consumers' Gas Co.

Topeka, Kan.—Railroad Grading.—W. T. Denton, Cleburne, Tex., and J. H. Maxwell, Topeka, Kan., for grading first 17 miles of projected Topeka-Southwestern R. R.

St. Paul, Minn.—Grading, Sewer.—Keogh Bros., at $7,900, for grading in Midway District; John Lind, at $3,000, for sewer in Lee Ave.

Stillwater, Minn.—Sewer System.—Wm. C. Fraser, Rochester, Minn., at $14,000, for sewer system at new state prison at Stillwater.

Two Harbors, Minn.—Sewer.—Haugsten & Johnson, Two Harbors, at $4,710, for material and labor for constructing 3,460 ft. of sewers.

Two Harbors, Minn.—Concrete Work.—McCloud & Smith, Duluth, Minn., for constructing concrete abutments for several bridges on D. & I. R. R. R.

St. Joseph, Mich.—Paving.—W. Worth Bean, Jr., for paving with brick and macadamizing several streets.

St. Joseph, Mo.—Sewers.—G. O. Skilbred Construction Co., at $7,306, for extending Wyatt Park main sewer; J. H. Hartman, at $1,997, for extension of Grand Ave sewer.

St. Louis, Mo.—Paving.—Schneider Granite Co., St. Louis, at $82,568, for improving Broadway.

Exeter, Neb.—Water Works.—National Construction Co., South Bend, Ind., for constructing air pressure system of water works for this place.

Oneida, N. Y.—Sewer.—Cornville Bros., at $1,164, for sewer in Lake and Elm Sts.

Elizabeth City, N. C.—Concrete Mill.—David E. Evans & Co., Baltimore, Md., have a contract to erect a new reinforced concrete lumber mill for the Dare Lumber Co., Elizabeth City, N. C. Contract price, $35,000. D. B. Banks, is designing engineer.

Defiance, O.—Sewer.—Peter Weigerding, for material and George Wohn for labor, for the construction of a sewer out North Clinton St., to cost $2,500.

St. Clairsville, O.—Water System.—J. R. Fitton, Bellaire, O., for installing new water system for court house and jail.

Lawton, Okla.—Bridges.—B. F. Hall, Hastings, Okla., at $5,774, for eight county bridges; Canton Bridge Co., at $12,374, for eight county bridges, and Midland Bridge Co., at $11,834, for nine county bridges.

Brighton, Pa.—Road.—Funkhouser & Hunter, New Brighton, Pa., for state road in Brighton Township.

Carmen, Pa.—Railroad Work.—Thos. A. Shoemaker, Bellefonte, Pa., for second track from Carmen to Brockwayville for Buffalo, Rochester & Pittsburg R. R. Contract is reported to amount to about $900,000.

Cumberland, Pa.—Road.—M. B. Bunyea, Chester, Pa., for state road in Cumberland Township.

Howe, Pa.—Road.—Reiter, Curtis & Hill, Philadelphia, Pa., for constructing state road in Howe Township, Perry County.

Mount Union, Pa.—Road Work.—W. H. Herr & Son, Altoona, Pa., for constructing 2½ miles of state road.

Hazelton, Pa.—Building Work.—G. W. Beard & Co., Reading, Pa., for additions to State Hospital at Hazelton.

Pittsburg, Pa.—Paving, Sewers.—M. O'Herron & Co., for paving 6th Ave., at $18,430, Webster Ave. at $14,606, and Glenwood Ave., at $13,877; also for sewer in Coltart Sq., at $12,598.

Tyrone, Pa.—Foundation Work.—American Railways Co., through A. S. Kibbe, Engineer, have awarded contract for the foundations of the power house of the Home Electric Light & Power Co., at Tyrone, to the Raymond Concrete Pile Co., of Chicago and New York.

Williamsport, Pa.—Sewage Purification.—Busch & Stewart for sewage purification plant for Keystone Glue Works.

Belle Fourche, S. Dak.—Canal Work.—Devore Bros. & Farlay, Vale, S. Dak., at $103,500 for constructing portion of South Canal, Belle Fourche Project.

Houston, Tex.—Bridge.—A. N. Fitzgerald, at $10,176, for wooden bridge with steel swing over San Jacinto River.

Chehalis, Wash.—Paving.—Anderson & Robinson, Chehalis, at $8,948, for macadamizing Prindle St.

Spokane, Wash.—Library.—Hastie & Dougan, at $117,500, for erection of library and assembly hall at the state college.

Olympia, Wash.—Bridge, Clearing and Grubbing.—Northwest Bridge Co., at $6,952, for constructing 180 ft. steel bridge over Wachougal River; C. W. Grader, Forks, Wash., at $320 per acre for clearing and $280 for grubbing on road No. 9. Last contract amounts to about $15,000.

Elmwood, Wis.—Water Works.—W. C. Fraser, Rochester, Minn., for water works for this place.

PROJECTED WORK.

Railroads.

Items Arranged Alphabetically by States.

Hollister, Cal.—San Juan Pacific Ry. Co. has filed its incorporation papers. Company has capital stock of $1,500,000 and proposes to build a railroad from Hollister to Watsonville. Frank D. Brown, San Francisco, Cal., Chas. E. Ladd, Portland, Ore., and Gustav Baumann, New York, are interested.

Redlands, Cal.—Proposition has been made to local Board of Trade for construction of railroad from this place to Hemet and San Jacinto. It is estimated that a road could be built for $600,000, and W. F. Whittier, San Francisco, Cal., has agreed to furnish $300,000 if these cities above named will also raise $300,000.

Vallejo, Cal.—Advices from this city state that Southern Pacific Ry. will probably build a 7-mile branch from Vallejo to Benicia and will lay out railway yards at Soscol, where the company recently purchased 40 acres of land. L. F. Champion, Oakland Pier, Cal., is Resident Engineer.

Whittier, Cal.—L. Scofield and A. Wardman, of local Board of Trade, are promoting project for a short line from Los Angeles to Whittier by way of Montebello, El Carmel and Ranchito.

Durango, Colo.—Surveys are reported under way by Denver & Rio Grande R. R. to locate a line from Chama via Ojo Caliente Hot Springs to a junction with the present Santa Fe-Antonio line at Servilleta. The line will follow the Chama River to El Vado. The new line will give Santa Fe a direct route to Durango, Colo., and make possible the abandonment of the present narrow gage from Chamita to Servilleta. J. G. Gwynn, Denver, Colo., is Chief Engineer Denver & Rio Grande R. R.

Cairo, Ga.—Efforts are being made to interest the Cairo Lumber Co. in a project for the construction of a railroad from Cairo south, through Havana, Fla., to be extended on to the Gulf and north of Cairo to Pelham. A company owning large tracts of timber land in the lower part of Grady county is also interested.

Waterloo, Ia.—Iowa & Northwestern Ry. Co., Stephen B. Howard, President, is reported to have secured necessary capital for the construction of its projected line southeast from Waterloo through Independence and Anamosa to Stanwood. Road would be 100 miles long and press reports state that construction work will be started this fall

Coffeyville, Kan.—This place has voted a $30,000 bond issue to aid in the construction of the Coffeyville & Memphis R. R. Co. This company will build a line from Coffeyville southeast to Centralia and Vinita, Ind. T. These two cities have already voted aid to the road. Eventually the company hopes to build into northern Arkansas. Work on the line as far as Vinita will commence at once.

Leavenworth, Kan.—Leavenworth, Kansas & Western Ry. has been granted leave to build a railroad track for a short distance on U. S. Reservation between its present trackage and the government terminals.

Ithaca, Mich.—Ann Arbor R. R., Jos. Wanbecq, Engineer, Toledo, O., is reported to be considering building a branch line from Ithaca or Alma to St. Louis, Mich.

St. Joseph, Mo.—Press reports from this place quote J. W. Brockett, Chief Engineer of the St. Joseph & Nodaway Valley Ry., as stating that all of the surveys have been completed between St. Joseph and Savannah and Tarkio and a good part of the right of way has been secured.

Edinburg, N. Dak.—Northern Dakota Ry. Co., capitalized at $200,000, has been incorporated to build a line from this place to the plant of the Pembina Portland Cement Co. in Cavalier county, N. Dak. Among those interested are: E. Thorwaldson, Mountain, N. Dak.; John Johnson, Edinburg, N. Dak., and S. J. Sigfusson, Mountain, N. Dak.

Jamestown, N. Dak.—Midland Ry. Co. is seeking right of way and depot grounds in this city, and right of way between here and Edgeley, 40 miles. Surveys are reported to have been completed from Redfield, S. Dak., to Pembina county, N. Dak.

Goldfield, Nev.—Nevada Hills Mining Co. is projecting construction of a railroad from Fallon, Nev., to the company's mines at Fairview.

Beaver, Okla.—Beaver Valley & Northwestern R. R., capitalized at $4,000,000 has been incorporated to build a line about 400 miles long extending from Oklahoma City, via Beaver City to La Junta, Colo. Among the incorporators are J. W. Webb, Ray Barnes and F. C. Tracy.

Portland, Ore.—A local press report quotes J. P. O'Brien, Portland, General Manager of Oregon R. R. & Navigation Co., as stating that actual construction work would be started about the first of the year on the Oregon & Washington R. R. Preliminary work on the road between Portland and Puget Sound is said to have been completed.

Erie, Pa.—Charter has been granted East Erie Connecting R. R. allowing it to construct a 2½ mile line in the suburbs of Erie. Capital stock is $25,000. Mathew C. Griswald, Erie, is President.

Pierre, S. Dak.—Omaha, Newport & Northern Ry. Co., capitalized at $8,000,000, with nominal headquarters in Pierre, has been incorporated. The proposed line is to traverse the counties of Douglas, Washington, Dodge, Colfax, Platte, Bowen, Wheeler, Holt and Rock in Nebraska. The incorporators are Ephraim Banning, Pierson M. Banning, Thomas C. MacPhillon, Oscar W. Boyd of Chicago, Ill., Clarence A. Miller of Minneapolis, Minn., I. W. Goodner and M. P. Goodner of Pierre.

Pecos, Tex.—Steps are being taken by citizens of this place to form a company to build a 40-mile railroad from this place to Balmorhea. The road is to be called the Pecos, Saragosa & Balmorhea Ry., and as soon as charter is obtained preliminary surveys will be started. About $40,000 has been raised for preliminary work.

Wichita Falls, Tex.—Wichita Falls, Lawton & Northwestern Ry. has secured funds necessary for the completion of the road from Red River in the Big Pasture to Lawton,—40 miles. President Bellamay has announced that grading on the line from a junction in the Big Pasture with the Wichita Falls & Northwestern will begin at once, and that the road will be completed to Lawton early next year.

Tacoma, Wash.—Seattle-Tacoma Short Line Ry., capitalized at $6,000,000, has filed its articles of incorporation. The road will be 30 miles long, double track, and it is said that construction work will be started as soon as remaining right of way can be secured. The franchises were obtained in the name of M. J. Wrightman and C. E. Muckler. Construction within two years, as specified by the franchises, is guaranteed by $14,000 deposit with the city of Seattle and a deposit has also been made with the treasurer of Tacoma.

Elkins, W. Va.—Extension of Western Maryland R. R. from Huttonsville to Webster Springs, 40 miles, is said to be under consideration. P. Cain, Elkins, W. Va., is Engineer Maintenance of Way.

Brantford, Ont.—Grand Valley Radial Co. has come under control of Pittsburg, Pa., capitalists and a number of changes are to be made according to General Manager Verner. These include a new line 30 miles to Port Dover, on Lake Erie. The road from Brantford and Galt will be reconstructed, shortened and new rails laid. A spur will be built to St. George. A new line will also be built west via Burford and Cathcart to Woodstock where the Thames Valley road, which has been acquired, will be used to Ingersoll and from there will be extended west to London. In all 94 miles of new road will be constructed.

Winnipeg, Man.—For the purpose of building a direct line between Winnipeg and Dawson City the Saskatchewan, Peace River & Dawson R. R. Co. is seeking incorporation from the Dominion Parliament.

Sewers.

Items Arranged Alphabetically by States.

Castle Rock, Colo.—City is considering installing sewer system.

New Britain, Conn.—Sewer Board has been instructed to prepare plans for construction of sewer in Black Rock Road. Sewer would cost about $25,000.

Clear Lake, Ia.—Estimates and plans are being made for sewer system for this place; probable cost $42,000.

Des Moines, Ia.—George D. Dobson, City Engineer, is preparing plans for Woodland Ave. and Pleasant St. sewer systems.

Quincy, Ill.—City will ask bids in April for construction of North End sanitary sewer. Appropriation of $30,000 has been made for the work.

Union City, Ind.—Union City "Register-Weekly" suggests that city officials secure engineer to map out sewer system for this place.

Topeka, Kan.—Surveys are under way for sewer to drain that portion of city near Quinton Heights and west to Washburn College campus.

Dayton, Ky.—A $28,000 bond issue for constructing sewers will be voted on Nov. 5.

Ishpeming, Mich.—Estimate of cost is to be made of installing sewer system in North 3d St. and in Vine St.

Morrice, Mich.—Injunction restraining this place from constructing drainage system has been dissolved and steps will be taken to hurry on construction work.

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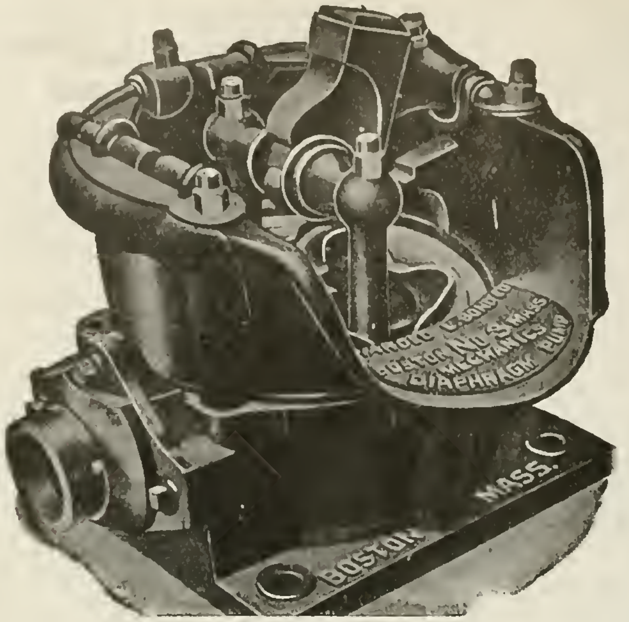

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SEPTIC TANK AND PUMPING STATION.

North Milwaukee, Wis.

Sealed bids will be received by E. H. Klamp, Village Clerk, until 7:30 p. m., Nov. 11, 1907, for the furnishing of all material and labor for the construction of a septic tank made of concrete, 42 ft. in diameter by 16 ft. deep with brick house 18 ft. in diameter by 10 ft. high, erected above it. Each bid must be accompanied by a certified check for 5 per cent of the amount of the bid. A bond of 50 per cent will be required of the successful bidder.

Plans and specifications may be seen on and after Nov. 4, at the village hall, North Milwaukee, Wis., at 31 Vroman Bldg., Madison, Wis., and at the Builders & Traders' Exchange, Milwaukee, Wis. The right is reserved to reject any or all bids.

W. G. KIRCHOFFER, Engineer,
Madison, Wis.
E. H. KLAMP, Village Clerk,
18-2t North Milwaukee, Wis.

PROPOSALS FOR STREET PAVING.

Columbia, S. C.

Proposals will be received by the Street Commission of the City of Columbia, S. C., until 12 o'clock m., November 25th, 1907, for paving Main Street with either Vitrified Brick, Wood-Block, Asphalt or "Bitulithic."

The work will embrace approximately 65,000 square yards of pavement, 17,000 lineal feet of combined concrete curb and gutter, and 4,500 lineal feet of concrete storm drains.

Plans are on file and may be seen at the office of the Street Commission at Columbia, or at the office of the Engineer at Winston-Salem, N. C.

Specifications will be ready and may be obtained from the Engineer after Oct. 30th.

Proposals will be opened publicly with the usual rights reserved.

J. L. LUDLOW, Engineer,
Winston-Salem, N. C.
CHAS. NAREY,
18-3t Chairman St. Commission.

U. S. ENGINEER OFFICE, Portland, Oreg., Oct. 18, 1907. Sealed proposals for furnishing and delivering four hoisting engines, three locomotives and two boilers will be received here until 11 a. m., Nov. 18, 1907, and then publicly opened. Information furnished on application. S. W. ROESSLER, Lt. Col., Engrs. 17-4t

TRUNK SEWER AND TUNNEL.

White Plains, N. Y., Oct. 10, 1907.
Office of the Commission, No. 2 Grand St.

Pursuant to the provisions of Chapter 646 of the Laws of New York, 1905, as amended by Chapter 747 of the Laws of 1907.

SEALED BIDS, addressed to the Chairman of the Bronx Valley Sewer Commission and accompanied by a certified check for at least five per cent of the amount of security required for the faithful performance of the contract for each section bid upon, will be received up to November 7, 1907, at one-thirty P. M., for furnishing all the work and materials necessary for the watertight and enduring

CONSTRUCTION of each one of the seven sections which together comprise about twelve miles of circular sewer from three and one-third to six feet in diameter and about three miles of circular lined tunnel mostly six and one-half feet and eight and one-half feet in diameter. The material to be either monolithic reinforced concrete, reinforced concrete blocks or brick masonry.

PLANS and specifications may be seen at the office of the Commission. The Invitation to Contractors, the Form for Bids, the Specifications and the Form of Contract and Bond may be obtained from the Secretary of the Commission upon the payment of one dollar, to be repaid when the same are properly used in bidding.

FORM OF BID must fulfill the requirements of the Invitation and be made out upon the printed Form of Bid as above obtained and the Commission reserves to itself the right to reject any or all bids or to accept that one or those whose acceptance will, in its judgment, best secure the public interest and the efficient performance of the work mentioned.

FRANK N. GLOVER,
Secretary.
Office of the Commission, No. 2 Grand St.,
White Plains, N. Y., October 10, 1907.
17-3t

PROPOSALS FOR WATER PIPE.

Office of the Superintendent of the Water Department of the City of Phoenix, Ariz., September 25, 1907.

Separate bids will be received by the Superintendent of the Water Works of the City of Phoenix, Arizona, at the office of the said Superintendent, up until 3:30 p. m., of December 1, 1907, for the following:

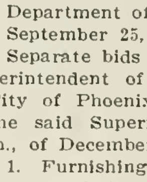
1. Furnishing all material and labor for the completion of contemplated improvements.
2. Supplying material only.
3. Necessary work for the installation of the same.

Specifications can be obtained, upon application, from the Superintendent, at City Hall, Phoenix, Arizona.

A certified check for five per cent of the amount of the bid, made payable to Frank Thomas, Recorder for the City of Phoenix, is to accompany each proposal, to be held as a guarantee that a contract with bond approved by him will be entered into by the party whose bid is accepted, in accordance with the terms of the said bid.

The Superintendent reserves the right to reject any or all bids, in whole or in part.

ROBT. CRAIG,
16-3t Superintendent.



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WANTED—Two experts on concrete and reinforced concrete construction, design of forms, etc., are open for engagement. Address "Experts," Engineering-Contracting, 355 Dearborn St., Chicago, Ill. 18-tf

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RAILROAD SHOP TOOLS—Having purchased six acres of ground for shops for repairing locomotives, rebuilding cars, making frogs, switches, etc., we desire to hear from manufacturers of machinery for such works. Railway Equipment Co., 324 Chamber of Commerce, Portland, Ore.

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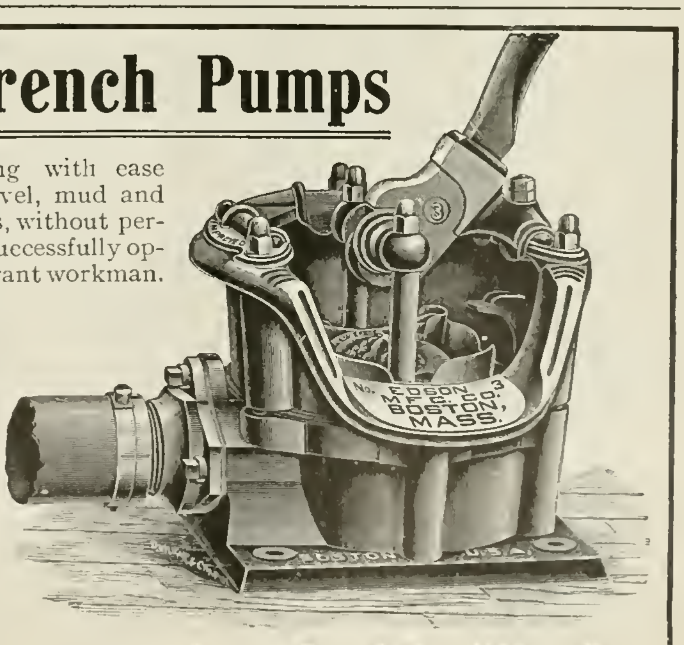

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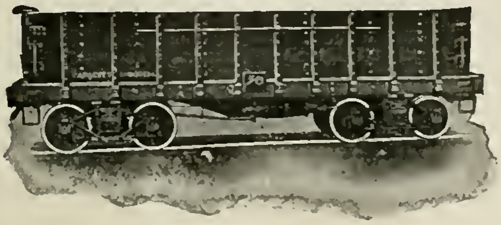

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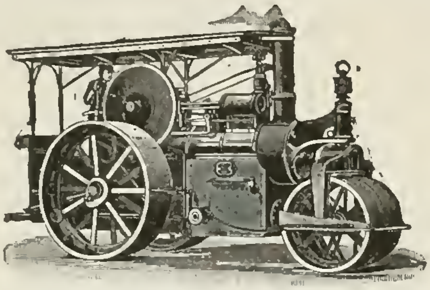

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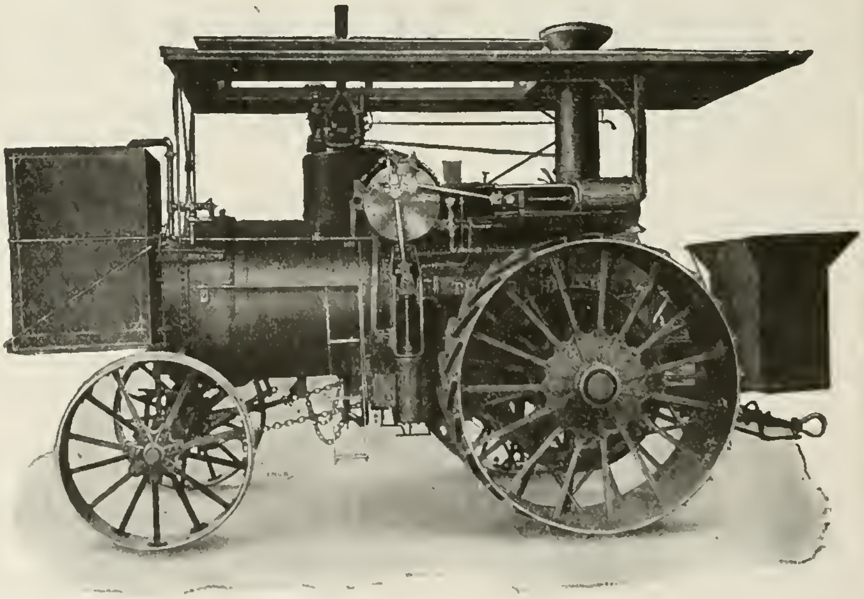

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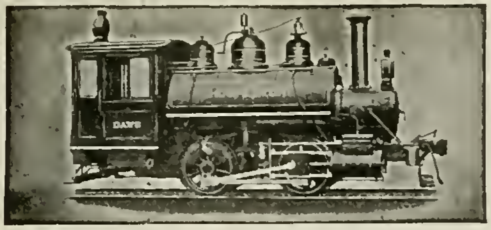

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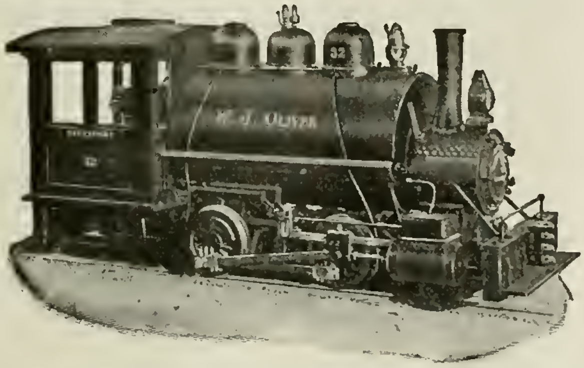

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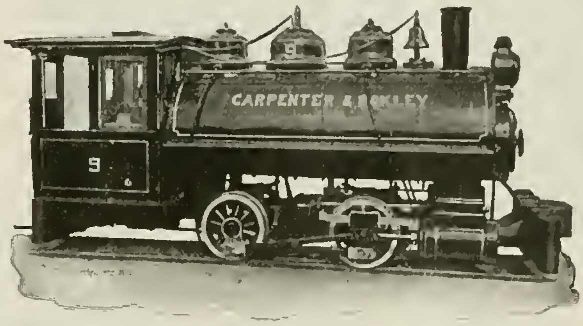

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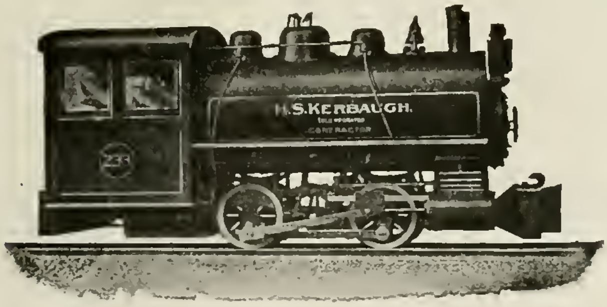

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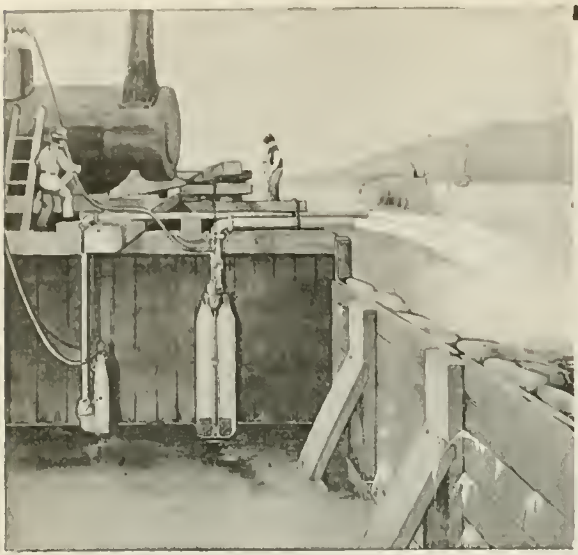

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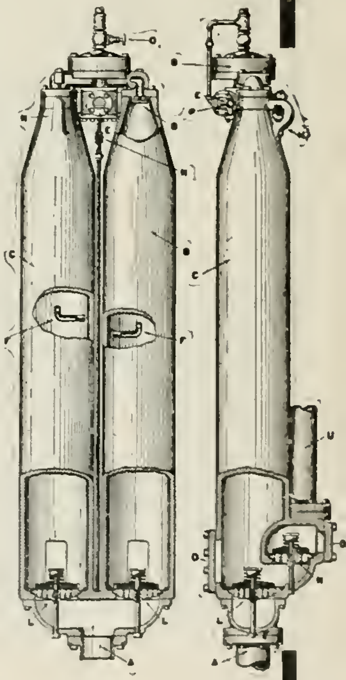

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No-Classification Contracts.

Elsewhere in this issue we publish an article by Mr. Lavis in which a legal battle over a railroad contract is discussed. The case, which adds another to the long list of its kind, arose from a combination of poor engineering and equally poor specifications.

In saying "poor engineering" it does not necessarily follow that the engineer himself was incompetent, but merely that his work was not properly done. This may have been due to parsimony on the part of his employers, who did not realize that a dollar saved in engineering often means a hundred spent in "lawing." However, it rests largely with the engineer to demonstrate that thorough surveys, including the driving of test pits and "soundings," form the most valuable investment that the projectors of a new railway can make. Indeed, we may go farther and add that a thoroughly competent engineer would probably resign his position rather than be forced to bow to the dictates of a board of directors who would not listen to his advice in matters of policy as to the nature and extent of his preliminary work.

Mr. Lavis is unquestionably right in urging that the "no classification" contract is one that invites disputes that are likely to end in law suits. Even a moderate change in alinement, after the contract has been signed, gives the contractor a legitimate claim for extra compensation, without furnishing a basis for amicable adjustment of the claim.

Mr. Lavis points out the inadequacy of the maps and records made by the railway engineers. In many instances their failure to make proper maps or records is due to a lack of knowledge as to good practice. Ignorance of this sort is no longer excusable when a book of the character of Lavis' "Railroad Location Surveys and Estimates" is available as a guide.

Was a Labor Cost of $6 per Cubic Yard Too High for Reinforced Pipe Construction?

Elsewhere in this issue we publish a letter from Mr. Arthur P. Davis, Chief Engineer, U. S. Reclamation Service. Mr. Davis takes issue with our statement (editorial in September 18) that $6 per cu. yd. is too high for merely the labor on reinforced pipe construction. We can not agree with Mr. Davis, and we are satisfied that any good contractor could have done this work for much less than it cost the government for labor.

In justification for this belief we shall refer to articles giving methods and costs of reinforced concrete conduits and sewers, which have appeared in Engineering-Contracting.

In our issue of May 9, 1906, the methods and costs of building a 4½ ft. pipe in France, were given in an article by Mr. Richard T. Dana. Deducting the cost of carrying all the materials in bags a distance of one-eighth mile, to the mixing board, we have left a cost of $1.60 per cu. yd. for mixing and placing concrete, shaping and placing reinforcements, and moving the forms. Wages were $1.50 a day. The ingenious method of moving the forms is well worth study.

In our issues of Aug. 22, and Oct. 10, 1906, and Feb. 20, 1907, are given methods and costs of reinforced sewer construction. Reduced to the same basis of $2.50 a day for labor, not one of these sewers shows a cost as high as two-thirds what it cost the government for labor on the reinforced concrete work under discussion.

Another interesting article appeared in our issue of Feb. 13, 1907, on the methods and costs of making 4 ft. concrete pipes for culverts, but as these pipes were cast in short sections, the costs are not strictly comparable with the others.

In Gillette's "Handbook of Cost Data," pages 365 to 383, will be found the costs of three reinforced concrete sewers and two conduits, not one of which begins to equal the $6 per cu. yd. for labor on the work under discussion, even when reduced to the $2.50 rate per day. Indeed, several of the examples show a labor cost per cu. yd. considerably less than half what this work cost the government.

In view of these facts, we are still of the opinion that our editorial statement that this work was far more expensive than it would have been under a good contractor is sound.

We entertain the most friendly feeling for the U. S. Reclamation Service and its engineers. They are a body of men dealing with difficult problems in a country that is so remote from the homes of most contractors that it is hard, at best, to secure reasonable bids. The bids that Mr. Davis quotes are certainly unreasonably high, and justify rejection. Our criticism of the Service was that it has not, as it seemed to us, exercised its ability to its fullest possible extent in reaching contractors and in convincing them that profitable work on a safe basis could be had under the Reclamation Service. The general clauses in the specifications may possibly need modification so as to throw less responsibility for unforeseen contingencies upon the contractor's shoulders. The average contractor must be convinced that Government work is not what it has often been, namely, a gamble as to the interpretation of specifications and as to leniency in time limits. There is no escaping the fact that contractors are afraid of Government contracts. The fact that few or no bids are received is largely due to this fear, and partly due to the existence of other work nearer home. The Reclamation Service has before it a campaign of publicity as to its methods and the fairness of its contracts and specifications. Our editorial of Sept. 18 was written largely to aid in this publicity, for we have absolute confidence in the desire of the Reclamation Service to draw fair and reasonable contracts. Indeed, we feel that the engineers of the Service will be among the first to meet a committee of the American Society of Engineering Contractors to discuss specifications. Already several engineers in the Service have applied for membership in the society.

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Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Method and Cost of Building a Reinforced Concrete Reservoir.

Reinforced concrete reservoirs are being built for small water supply plants of various towns and small cities, but one great use for them is in connection with manufacturing plants.

That the number of such reservoirs will rapidly increase can hardly be questioned, as there are many features to commend them. As they are built below the surface of the ground, and owing to the fact that the top can be designed to stand any load, the tank or reservoir can be built within a manufacturing plant without occupying valuable space.

The underwriters' associations of various sections of the country have approved such reservoirs for fire purposes, and have reduced the rate of insurance for plants so equipped below that given for factories with the roof tank protection. Another commendable feature is that the water in them does not freeze to any great depth, even in very cold countries.

General Description.—The reservoir to be described was designed for fire purposes in a machine shop to be used in connection with an automatic sprinkler system. It was to hold 75,000 gallons, and a Blake pump with a capacity of a thousand gallons a minute was installed to pump the water from the reservoir. The pump and the sprinklers were furnished under a separate contract from the reservoir, and this article will deal only with the latter. The water supply was taken from the mains of the city, in which the plant was located.

The construction of the tank was done by contract, a lump sum price being bid upon the work. This included the placing of all pipes and fittings in the reservoir and a manhole with suitable cover in the top.

The structure was designed by the Trussed Concrete Steel Co., of Detroit, Michigan, the Kahn reinforcing bar being used throughout. One of the editors of this paper built the reservoir. The specifications stipulated that the reservoir should hold 75,000 gallons, the water line being one foot below the top, that it must be absolutely water tight, and the top should be capable of sustaining a dead load of 300 tons evenly distributed, and a live load of 5,000 lbs. upon two wheels. The contractors guaranteed the reservoir for six months. The only trouble experienced was in the waterproofing. As the reservoir has been in use several years, it has now been tested in a thorough manner.

Fig. 1 shows plan of structure and reinforcing of the top. Figs. 2 and 3 are sections across the reservoir, the first being the long way of the structure. Fig. 4 gives details of a column. The accompanying table gives the number, length and size of rods and their respective locations. It will be noticed that everything is reinforced with the exception of the floor. As this was laid on a stiff clay and rotten rock, it was not necessary to use steel in it.

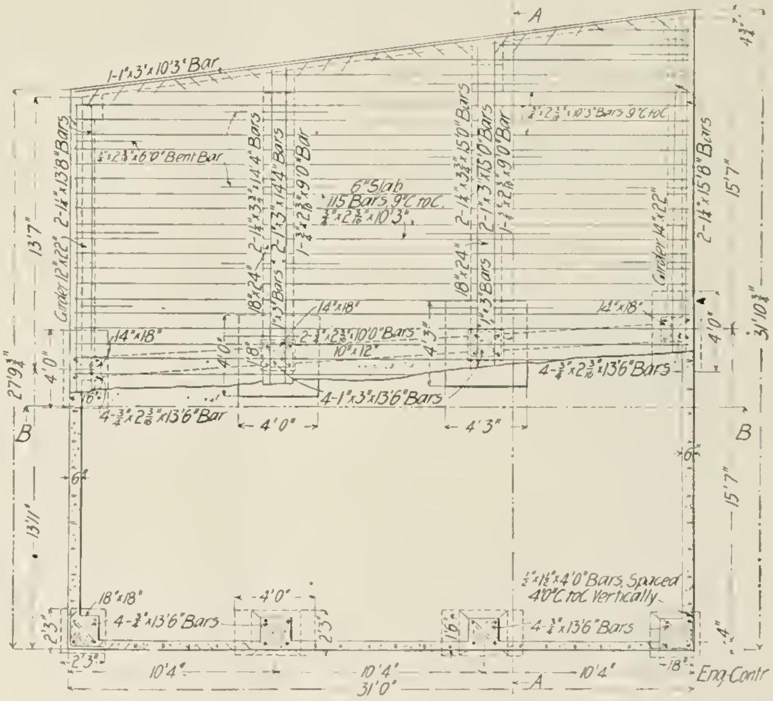

Fig. 1—Sectional Plan of Reservoir.

Quantities of Work.—The excavation called for the removal of 579 cu. yds. of earth. There were 83 cu. yds. of concrete in the structure, although the plans called for less, the additional amount being used in increasing the two 4-in. walls to 6 in. and increasing the bottom and top, on one end, so as to give perfect drainage. The yardage was divided as follows:

	Cu. Yds
Footings	3.5
Columns	6.8
Sides	22.6
Girders	11.0
Top	20.0
Floor	19.1
Total	83.0

A manhole had to be put in the top and a sump in the bottom. Several pipes also had to be placed in the concrete. None of these details is shown on the plan. The structure had to be waterproofed.

Excavation.—The excavation was made with pick and shovel and the material hauled away in carts, the distance to the dump being 700 ft. The top was shoveled directly into the carts, while the rest was handled two and three times. When the reservoir was finished dirt had to be filled in around the sides and puddled. For details of the cost of excavation see Engineering-Contracting, March, 1906, page 63.

Wages.—The following rates of wages were paid on the job:

Foreman	$3.00
Carpenter	3.50
Carts and driver	3.50
Laborers	1.50

The carpenters worked 8 hours a day and were paid time and a half for overtime. The rest worked ten hours per day and were paid regular rates for overtime.

Forms.—Carpenters framed and erected the forms, but laborers did all the carrying for them. Laborers also tore down the forms. For the girders and columns 2-in. boards were used, but for the sides 1-in. boards with 3x4-in. scantlings were used. The props for supporting the girder and top forms were 3x4. Except for columns and girders and some props, all the forming was used three times. The lumber cost:

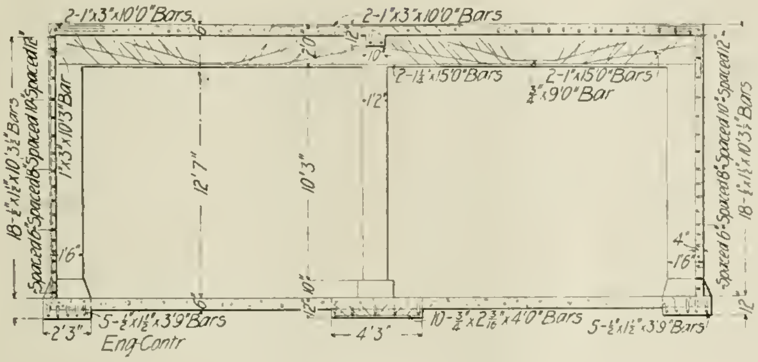

Fig. 2—Transverse Section on Line AA in Fig. 1.

400 ft. B. M. at $24	$ 9.60
8,000 ft. B. M. at $18	144.00
Total	$153.60

This makes an average price per 1,000 ft. of about $18.30, which price we shall use in giving costs.

The cost of framing and erecting the forms was $167.27 for the sides, columns, girders and top. In the forms for the sides, forming was only used on one side of the concrete for two sides, the earth bank being used for the other side of the forms, but on the other two sides the banks had caved in, and forming was used on both sides of the wall. The cost per cubic yard for forms was:

Lumber	$2.54
Framing and erecting	2.77
Tearing down	.54
Total	$5.85

This cost is for the yardage of 60.4 on which forms were actually used. For the total yardage in the tank the cost was:

Lumber	$1.85
Framing and erecting	2.01
Tearing down	.40
Total	$4.26

The common labor cost of assisting to erect the forms was 15 per cent of the total. Nothing is allowed for foreman, for the contractor acted as his own foreman.

The cost of forms per 1,000 ft. for the amount of lumber purchased was:

Lumber	$18.30
Framing and erecting	19.90
Tearing down	4.00
Total	$42.20

As the lumber was used three times, the cost per thousand for all work and materials on the forms would be just one-third of this—namely: $14.06.

Since the framing, erecting and tearing down cost $19.90 plus $4, or $23.90 per M. ft. B. M. purchased, and since the lumber was used three times, the labor cost nearly $8 per M. each time that the lumber was used. It will be noted that 8,400 ft. B. M. were required for the 83 cu. yds. of concrete, or a trifle more than 100 ft. B. M. per cubic yard.

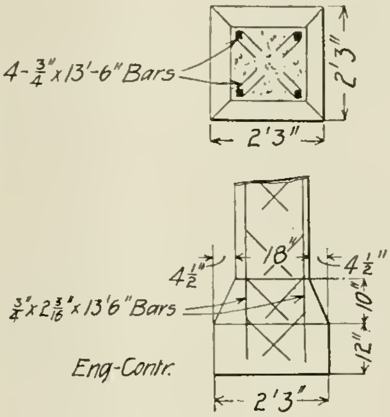

Fig. 4—Details of Columns.

It will be of interest to see the labor costs of forms for the various parts of the structure.

For the sides the cost of framing and erecting the forms was $4.19 per cubic yard. Of this cost 4 per cent was for common labor and the rest for carpenters. The tearing down cost 47 cts. per cubic yard. For the columns the erecting was $2.35, of which 1 per cent was for common labor. The tearing down cost 47 cts. For the girders and top the erecting cost $1.83, of which 35 per cent was common labor. The tearing down cost 61 cts. per cubic yard. A summary would show:

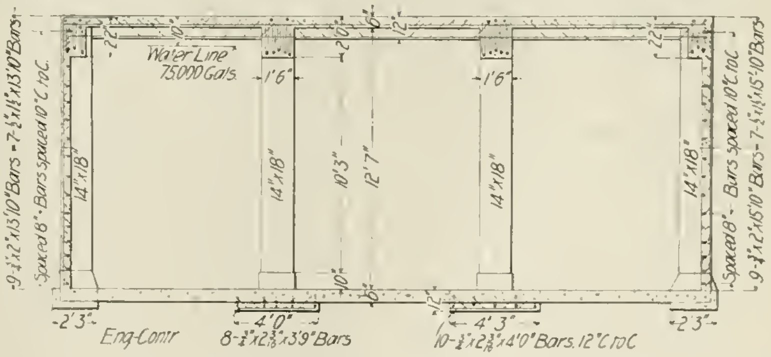
9-¾"x2"x13'10" Bars - 7-½"x1½"x13'10" Bars
Spaced 8" - Bars spaced 10" C to C
2'2"
10"
Water Line 75000 Gals.
1'6"
2'0"
6"
12"
1'6"
2'2"
14"x18"
14"x18"
10'3"
12'7"
14"x18"
14"x18"
Spaced 8" - Bars spaced 10" C to C
9-¾"x2"x15'10" Bars - 7-½"x1½"x15'10" Bars
10"
6"
12"
2'3"
4'0"
4'3"
2'3"
Eng-Contr
8-¾"x2 3/16"x3'9" Bars
10-¾"x2 3/16"x4'0" Bars. 12" C to C

Fig. 3—Transverse Section on Line BB in Fig. 1.

	Sides per cu. yd.	Columns per cu. yd.	Girders and top per cu. yd.
Framing and erecting	$4.19	$2.35	$1.83
Tearing down	.47	.47	.61
Total	$4.66	$2.82	$2.44

The greater cost of the columns forms over the girders and top was due to the fact that the columns forms were handled almost exclusively by the carpenters, and also in setting them great care and much time had to be used to get them plumb and in line. The cost of the forms for the sides was about twice as great as that for the top and girders. The reasons for this are evident. The walls had forms on both sides, while the top needed forming only underneath it, the area covered on the forms being about 2,200 sq. ft. as compared to 1,000 sq. ft. The side forms had to be set plumb and kept so. The framing was done ahead, but nearly half of the lumber in the sides was erected as the concrete was being put in place. The forms for the top were all put in place before any concreting was done on the top, and the carpenters discharged. A much larger per cent of common labor could be used in placing forms for top and girders than on the sides. The props were nearly all put in place by laborers. The extra cost of tearing down the forms for the top was due to the fact that the lumber all had to be handled one piece at a time through a small manhole in the top, and carried about 150 ft. to be piled.

The writer believes that the proportional costs of the forms for the different parts of this structure will be found approximately correct for similar work on buildings. In Engineering-Contracting, Nov. 28, 1906, some costs for erecting girders and floors for some light bridges are given that will compare favorably with the labor cost for the top of this reservoir.

To all the costs for forming should be

added 6 cts. per cubic yard for nails, wire and lines used on the forms.

Concrete.—The mixtures varied for the different members. The cost of materials was as follows:

Cement, 110 bbls. @ $1.12	$123.20
¾-in. stone, 80 cu. yds., @ $1.86	148.80
Gravel, 3 cu. yds., @ $1.33	4.00
Sand, 42 cu. yds., @ $1.20	50.40

The sides were first put in place, then the center columns were built, following which the bottom was placed. Then the forms were erected for the top and the girders, and these cast. In building the sides, one side and half of the two ends were built at one time, and then forms erected for the other half of the sides. For the sides the mixing was done in the bottom of the reservoir. For the rest of the structure it was done on the ground, the mixing board being along side of the reservoir. The labor cost of the concrete work for the various members and the average per cubic yard was as follows:

	Sides.	Columns and Foot'ns.	Bottom.	Girders.	Top.	Average.
Cu. yds.	22.6	10.3	19.1	11.	20.0	83.
Preparing and cleaning up	$0.166	$0.060	$.....	$0.095	$.....	$0.065
Handling materials	1.022	.306	.070	.198	.187	.404
Cleaning out forms	.040	......	......	.070	.053	.032
Mixing and placing	1.542	.728	.353	.792	1.080	.952
Ramming	1.090	.540	.455	.450	.597	.673
Handling steel	.890	.020	......	.395	.083	.324
Total	$4.750	$1.654	$0.878	$2.000	$2.000	$2.456

The total cost of labor was $203.35. The mixing was done entirely by hand. Some plastering was done to the walls after the forms were taken off, and the sides and bottom were washed with a brush with cement and water. The plastering cost $6.60, including a barrel of cement and the washing or grouting, two coats, cost $9.10, including a barrel of cement. This added a cost of 19 cts. per cubic yard to the concrete work, making the total cost per cubic yard $2.65.

It was a mistake to have mixed the concrete for the sides in the bottom of the reservoir, as it made two handlings of the materials and compelled all the concrete to be raised by hand to place it in the forms. This accounts for the high cost of these two items.

The handling of the steel was high for the side walls, as it was all separated and put into piles for the different panels and members in getting it out of the pile for the sides. The rammers not only rammed the concrete but they also bent down the prongs of the steel to get them in place in the narrow forms, and afterwards had to pull out these prongs. This had to be done for every piece of steel used, and readily doubled the cost of ramming. The high cost of ramming the top was caused by the fact that the 6 ins. of concrete had to be placed in three layers and each rammed. The steel handling was high on account of the prongs that load the pieces in with others, making them hard to handle. The cost of handling steel per ton was about $4, or 0.2 ct. per pound. The steel was all handled by common laborers.

The stock piles of material had to be made along a street and alley and thus caused the material to be handled in wheelbarrow several hundred feet.

The preparing to mix concrete, the cleaning up afterwards and the cleaning out of forms are items that are seldom kept separate from the others.

The cost of mixing and placing is high, owing to the fact that working space was small and the mixers had to wait until the concrete was taken off the board and placed in the forms before starting another batch. This also meant an increased cost in the ramming, as the rammers were idle some time waiting for a new batch to be mixed.

The total cost of concrete, including labor and materials, per cubic yard on a basis of the 83 cu. yds. was:

	Per cu. yd.
Cement, 1 1-3 bbls., @ $1.12	$ 1.49
Stone, 1 cu. yd	1.86
Sand ½ cu. yd	.60
Steel	4.76
Forms, 100 ft. B. M., @ $18.30	1.85
Labor on forms	2.41
Labor on concrete and steel	2.65
Total	$15.62

The cost of a foreman is not included in this, as the contractor looked after the men himself.

Waterproofing.—The waterproofing of the structure proved a serious problem. It was thought at first that the concrete itself would be nearly water tight, but the tank leaked like a sieve. After considering several methods, an agent of a European waterproofing mixture prevailed upon those interested to try his compound. To apply it, the walls had to be dry, so a large coal burning stove was put in the reservoir and a fire kept up day and night. While this drying process was going on several light falls of snow occurred, and this had to be cleared away to make the walls and roof dry. Two coats of the mixture were applied according to the agent's instructions, and the reservoir was tested. The water fell nearly half a foot in an hour's time.

Then a waterproofing contractor agreed to make the reservoir water tight with paper and tar, by applying it on the inside. Three thicknesses of paper were laid on the bottom and run well up on the sides, each layer of paper being well covered with a preparation of tar. Upon testing it, it was found that the leaking had been reduced about 50 per cent. A preparation of asphalt was then placed over this, but upon a third test the tank still leaked. As the sub-contractor had verbally agreed to make it water tight for $125, only this amount was paid him. After this last test he refused to do any more work.

After these attempts the sides of the reservoir were exposed on the outside by excavating around it, and a one-brick-wall built up a few inches from the concrete. This space was filled in with rich cement mortar and the ground once more filled in around the structure. This work and the materials used in it cost $1,240. Upon a fourth test the reservoir was found to be water tight. Thus more than a third of the cost of the entire work was in waterproofing the structure, and this made the contract a money losing one, as this heavy cost was not anticipated.

Miscellaneous Work.—Several items of miscellaneous work are listed in the total cost of the reservoir, such as filling in and puddling around reservoir and replacing cobble paving. The top of the structure was used as a bin for the storage of coal. For this purpose eight I beams were embedded in concrete around the top, to be used as posts for the sides of the bin. The cost of placing these is given.

Total Cost.—The cost of the structure without any profits was:

579 cu. yds. excavation @ $.896	$ 529.65
Steel	395.00
Crushed stone	148.80
Gravel	4.00
Sand	50.40
Cement	123.20
Lumber	153.60
Labor on forms	200.09
Labor on concrete	203.35
Plastering	6.60
Sides and bottom	9.10
Nails, wire, etc	4.98
Baling water	21.19
Building temporary fence	1.65
Extra excavation for forms, footings, etc	13.90
Setting I beams in concrete	17.65
Filling in and pudding around reservoir	34.47
Replacing cobble paving	4.30
Hauling tools	3.60
Heating reservoir and handling snow	14.50
Waterproof mixture	29.00
Labor applying it	9.74
Applying paper and tar, labor and materials	125.00
Labor and materials of final waterproofing	1,240.00
Tools	48.75
General expense	210.00
Total	$3,602.52

The reader is referred to previous articles on the subject of the cost of forms and erecting concrete structures in Engineering-Contracting of Oct. 23, 1907, p. 232; Oct. 9, 1907, p. 200; Oct. 2, 1907, p. 191; Nov. 28, 1906, p. 160.

It is now estimated that it will take four years to construct the lighthouse at Ushart on the French coast. Owing to the location and roughness of the sea only 152 hours work were possible last year on the foundation.

Cost of Molding and Laying Concrete Blocks for a Factory Building.

A group of large factory buildings is being completed at Grand Rapids, Mich., by day labor by the owners, using hollow concrete blocks. The buildings range from one to four stories in height and altogether occupy some 74,000 sq. ft. of ground; they form the new works of the Grand Rapids Refrigerator Co., to which we are indebted for information. The owners installed their own block making plant and have done most of the other work by day labor. The plant was fully equipped with curing racks, five block machines made by the Ideal Concrete Machinery Co., South Bend, Ind., two machine mixers made by the National Concrete Machinery Co. of Chicago, Ill., and operated by a 5 h.p. gasoline engine, platins, tools, etc.

The walls were constructed of 24-in. square pilasters of blocks arranged as shown by Fig. 1, connected by curtain wall belt courses of single blocks. The blocks were 8x8x16 ins., and after molding the faces were bush hammered and the edges tooled. The pilasters, consisting of four blocks laid around an 8x8-in. hollow space, were solidified by pouring the 8x8-in. space and all but the three outside block cavities with wet concrete. The interior of the building was of regulation mill construction, and as the pilasters reached the heights for beam supports cast iron plates with downward flanges were set in the concrete. These plates had a cast pin projecting upward to fasten the beam end.

The materials used for the blocks were Sandusky Portland cement and ¾-in. bank gravel well balanced from fine to course. The blocks were molded with 1-3 mortar faces, the mortar being waterproofed by a mixture of Medusa waterproofing compound. All concrete was machine mixed. The men operating the block machines were paid 1 ct. for each block molded, so that their pay depended upon the energy with which they worked. The men handling materials and engaged in handling and curing the blocks were paid $1.75 per day. The gravel was shoveled from the railway cars onto the screens and from the screen piles to the mixers. The gang was organized as follows:

Item.	Per Day.
8 men handling materials, at $1.75	$14.00
5 men operating molds at 1 ct. per block	15.00
1 man mixing facing mortar, at $1.75	1.75
2 men loading blocks onto trucks, at $1.75	3.50
2 men unloading blocks from trucks, at $1.75	3.50
3 men sprinkling blocks, at $1.75	5.25
Total, 21 men molding and curing blocks	$43.00

The average daily run was 1,500 blocks, or 300 blocks per machine.

This output was easily maintained after the gang got broken in; sometimes it ran higher and sometimes lower, but the average was as given. The men operating the block machines thus earned $3 each per day. The labor cost of molding and curing per block was thus 2.87 cts. As the blocks had about 25 per cent hollow space, each block 8x8x16 ins. contained 0.45 cu. ft. of concrete; a cubic yard of concrete, therefore, made 60 blocks, so that the labor cost of making the blocks was 60×2.87 cts. =$1.72 per cubic yard. This cost does not include foreman's time, materials, interest, depreciation or general expenses. It was estimated by the owners that the blocks cost them 9 cts. apiece cured, or about $5.40 per cubic yard of concrete. This 9 cts. evidently includes materials and labor alone.

Upon removal from the molds the blocks were loaded onto cars, taken to a large shed and there unloaded onto shelving arranged to hold five rows of blocks one above the other, two blocks opposite each other on each shelf. The blocks were left in the shed 24 to 48 hours to get the preliminary set, then they were loaded on small cars and taken to the yard, where they were removed from the cars and stacked. They were sprinkled every day for six days, being kept covered meanwhile with oiled cotton cloth. The labor costs given above include molding, sprinkling and handling the blocks up to this point.

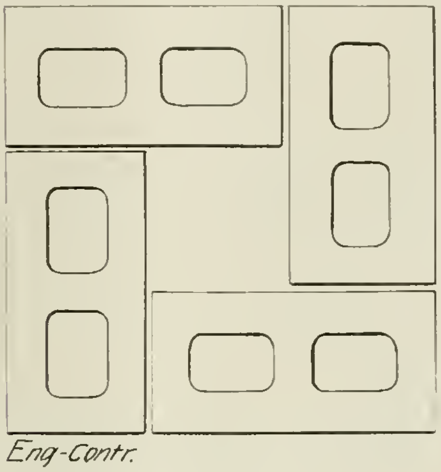

Fig. 1—Sketch Showing Arrangement of Blocks in Pilaster.

To lay the blocks they were again loaded on cars and run to an elevator in a wooden tower outside the building. The elevator lifted the car to the floor on which the blocks were to be used, where it was run off onto a track reaching the full length of the building. The blocks were unloaded directly behind the masons. Where the walls were high enough for scaffolding the blocks were unloaded directly onto the first scaffold and, when necessary, handed up to the scaffolds above. The masons employed were regular stone masons receiving the regular scale of wages of $3.50 per day. The number of blocks laid by each mason was 125 per day in building pilasters and 200 per day in building plain wall. Sometimes 250 blocks per day per man were laid in plain wall work. The cost per block of laying above was thus 2.8 cts. in pilasters and 1.75 cts. in plain wall. This cost does not include transporting the blocks from yard or of handling them to the scaffold behind the masons, nor does it include the cost of materials and labor for mixing and delivering mortar.

One of the features of this work was the method of transporting the blocks by cars. A complete system of tracks was provided covering the block plant and yard, the building sites and the several floors of the buildings themselves. All blocks and other materials were transported by cars running on these tracks, both cars and tracks being of the type made by the Chase Foundry & Manufacturing Co. of Columbus, Ohio.

Various attempts have been made to convert the peat bogs of Ontario, Canada, into fuel for domestic use. The latest of these attempts is described by a recent consular report as follows: Over the top of the bog has been placed a series of railway tracks about 5 yds. apart, and over them run what are called collectors. The collector can be compared to a large electric can equipped with a suction pan. From the side of the car protrudes a long pipe, perhaps 2 ft. in diameter, at the end of which is a shoe with a "lip," through which the dry peat dust on the surface of the bog is drawn into the pipe by suction and deposited in the car. One collector will pick up 50 tons of dust a day. The sun quickly dries the exposed surface which has been uncovered by the collector, and the same process is then repeated. The dust is taken from the collector into the factory, and run through a large pipe, or covered trough, through which runs a screw similar in shape to an augur. Around the outside of the pipe or trough is a steam jacket placed several inches from the pipe to allow steam to pass through the space between, in order to dry out the dust passing through the inside of the pipe. The dust is ground fine enough to pass through 100 mesh and is then placed in a press and at a temperature of 200 degrees and at a pressure of 80 tons formed into bricklets. In two days after going through the press the bricks are harder than coal and nearly the same color. The dust itself can be treated and used as fuel in large furnaces. The dust after being treated is blown into the furnace in the same fashion as coal dust is used in brick kilns and explodes and makes gas within 10 ft. after being blown into the furnace.

The St. Lawrence Power Co. of Canada, and the Long Sault Development Co. have laid a proposition before the International Waterways Commission for the development of water power at Milleroches, on the St. Lawrence river, which would involve the expenditure of $20,000,000.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Cost Keeping on Railroad Construction.

BY J. P. HALLIHAN.*

In constructing railroad or other public work under contract it is always advisable, and frequently essential, that the engineer should have accurate knowledge of the cost of the work.

While it is not always necessary that he should have a complete cost-analysis, showing subdivision of cost per unit of measurement, it is required that the cost per unit in various locations, as in each cut, should be at his command, as well as the manner of handling, disposition of material and time consumed.

Force reports in use on railroad work are not designed to secure this information, except in a very general way, usually giving a mere statement of force employed each day, without regard to costs.

The accompanying forms were used on some recent work in the Southwest, and were intended to collect all the data required in shape for condensation or further analysis, but the initial form was made as simple as possible, calling for no calculation on the part of foremen.

The field report (shown as Form 1) is bound in books of 35 duplicate sheets, colored white and yellow, the white sheet being perforated for removal. In the case of company work, the form is filled in duplicate, using carbon, then torn out and the information called for on reverse side (distribution of labor and foreman's estimate of material moved or work done) is filled in, carbon impression being taken on reverse side of sheet retained in book. The sheet is then delivered to the timekeeper, who checks the time given on report against the time which he has personally taken, and forwards report to the division engineer. On isolated jobs, or with small gangs where no timekeeper is employed, the report goes direct to General Foreman or Division Engineer. At the end of the month all books are sent to office of Division Engineer, who is thus put in possession of the original record of each day's work.

Where work is being done by a contractor, the data are obtained by force reporter, using same form, omitting, of course, the names of employes, and noting only the total number of each rate. The other information is obtained from foreman's statement, checked by personal observations.

Form No. 2 is a condensation of daily reports into a weekly report, showing distribution of force on each section and total cost for period covered. Quantities moved may be closely approximated from daily reports and profits, and inserted in weekly report, if desired.

Accurate statement of quantities moved is, however, shown on the monthly sheet (Form No. 3) as derived from engineer's estimates. Form No. 3 also shows total force and cost for month of work done on each section. It can also be arranged to show grand total cost of each section since commencement of work, and, for the use of a general contractor, this would obviously be required.

The daily report form is used for all classes of work, the weekly and monthly reports being printed to conform to nature of work and information required.

FOREMAN'S DAILY TIME REPORT.

Work done on sect.... .. .. 190...
By .... Foreman.
Between sta.......... ....and sta..

Name.	Time.	Rate.	Name.	Time.	Rate.

Teams:					
4-plow			Supply		
6-plow			Cart		
8-plow			Stone boat		
Slip			Wagon		
Fresno			Car		
Wheeler			Water		
Snatch			In corral		

MATERIAL USED.

Pounds of Dynamite.	Kegs Black Powder.	Feet of Fuse.	Number of Caps.	No. and length of Exploders.	Sacks of Cement.	Liters Black Oil.	Liters Cy'l Oil.	

Class of work:
Clearing. Excavation. Earth. Loose rock. Solid rock.
Borrow. Waste. Haul........ ....Meters.
Tunnel No.... .. .... Structure No.. ....
Cross out words not necessary to express nature of work.
(OVER)

Form 1—Front of Form for Foreman's Field Report.

DISTRIBUTION OF LABOR.

No.	Employe.	Time.	Rate.	
	Foreman			
	Sub-Foreman			
	Laborers			
	Drillers			
	Nippers			
	Water boys			
	Blacksmiths			
	Blacksmith Helpers			
	Drivers			
	Corral men			
	Bridgemen			
	Timbermen			
	MISCELLANEOUS: Work done, etc.			

..... Foreman.

Foreman will fill this blank out daily and forward to timekeeper.

Form 1—Back.

(Actual size of this blank is 9 in. high by 5¼ in. wide.)

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*1321 Boulevard, El Paso, Tex.

No-Classification Contracts for Railroad Graduation.

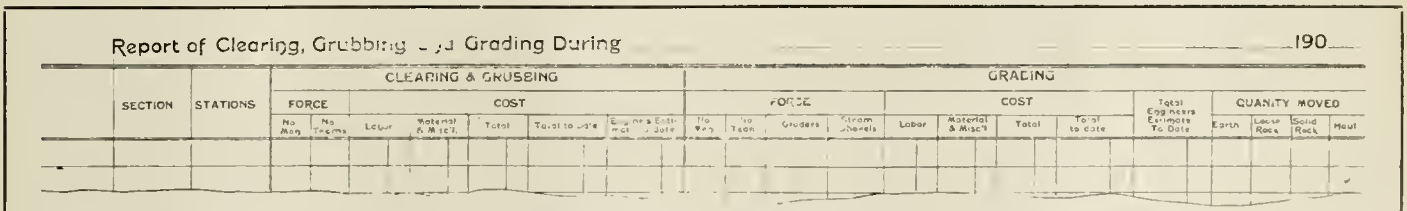
BY F. LAVIS, M. AM. SOC. C. E.*

In March, 1907, a paper entitled "Uniformity of Requirement and Clearness of Specification in Agreements for the Graduation of Railroads," by W. F. Dennis, M. Am. Soc. C. E., was read before the American Society of Civil Engineers and discussed by several of the members, among the latter being the writer, who was practically alone in advocating a no-classification contract. This paper was reproduced in ENGINEERING-CONTRACTING of Jan. 30 and Feb. 6 and the writer's discussion in the issue of March 13 of the current year.

FERROCARRIL, RIO GRANDE, SIERRA MADRE Y PACIFICO																																		
FORCE REPORT—GRADING.																																		
Contractor					Division No.				Section Nos.					Station											To Station							190.		
			Clearing & Grubbing.		Excavation and Borrow.																				Material Used.					Costs.				
												Teams.																						
																				Plow.														
Date.	Section.	Stations.	Foreman.	Laborers.	Foremen.	Laborers.	Drillers.	Nippers.	Water boys.	Blacksmiths.	Blacksmith Helpers.	Carts.	Stone Boat.	Slip.	Fresno.	Wheeler.	Snatch.	Supply.	Water.	4	6	8	In Corral.	Total.	Dynamite, Lbs.	Black Powder, Kegs.	Fuse—Feet.	Caps No.	Exploders No. and Length.	Labor	Material.	Camp and Miscellaneous.	Total.	Remarks.
Totals																																		
@ Cost																																		
NOTE.—Under Camp Costs show fixed cost of Camp, which consists of General Foreman, Timekeeper, Corralman, Cook—all fixed employes of camp except Commissary Clerk, who is chargeable to Commissary.																																		
Checked:																				Correct:														
Const. Eng.																				Line Rider.														

Form 2—Form for Weekly Report.

(Actual size of this blank is 20 ins. wide by 8 in. high.)



Report of Clearing, Grubbing and Grading During 190

			CLEARING & GRUBBING							GRADING												
	SECTION	STATIONS	FORCE		COST					FORCE				COST					QUANTITY MOVED			
			No Men	No Teams	Labor	Material & Misc'l.	Total	Total to date	Engineers Estimate to date	No Men	No Team	Graders	Steam Shovels	Labor	Material & Misc'l	Total	Total to date	Total Engineers Estimate To Date	Earth	Loose Rock	Solid Rock	Haul

Form 3—Sheet for Monthly Report.

(Actual size of this sheet is 17 ins. wide by 13 in. high.)

Quite recently the writer was connected with a case where it was necessary to resort to arbitration to settle differences of opinion which arose between the contractors and a railroad company in regard to the final settlement of a contract on the no classification basis, and it is believed that a brief statement of the points at issue will be interesting to both engineers and contractors engaged in this class of work.

For the benefit of those who have not access to a file of ENGINEERING-CONTRACTING or the Transactions of the American Society of Civil Engineers it may be stated that the writer's argument for a no-classification basis for grading contracts on railroads is based on the premises that the most thorough and complete engineering investigation of the project is necessary before a contract can be let on this basis with any prospect of an equitable agreement between the parties to it. He believes that if such investigation is made, and proper plans and specifications drawn up, so that the work to be done can be clearly and definitely defined before the contract is let, the lower price bid for the work will much more than cover the entire expense of the engineering, besides which of course such a procedure is the correct one in any case.

In the particular case referred to, the form of contract was the usual one-sided affair in favor of the railroad company, which unfortunately, under present conditions, contractors are obliged to sign if they expect to get work enough to stay in the business. It may be noted in passing, however, that this one-sided form of contract is not altogether due to the fact that the railroad companies always endeavor to get the best of the contractor, but is rather the cumulative effect of their having inserted clauses from time to time in order to protect themselves in future contracts after having got the worst of the bargain with some previous contractor who has squeezed out of a hole through some technicality.

The following clauses from the specifications and contract cover the most important points of the dispute in the case under consideration:

a. "Material required for embankments and not supplied by the excavations within cuttings of the usual widths and slopes or from other excavations incident to the construction of the road, *shall be obtained by widening these cuttings,*" etc., etc., and then follows the usual provision for ordinary borrow.

b. "Contractors must satisfy themselves of the nature and location of the work they bid for, of the general form of the surface of the ground, of the quantity of materials required for forming the embankments or other work, and all other matters that can in any way influence their contract," etc.

c. "The quantities and disposition of excavation . . . may be changed during the progress of the work at the pleasure of the chief engineer, by alterations in the line of the railroad or in the grades, curves, etc., . . . for the purpose of more nearly equalizing or balancing the cuttings and fillings, etc."

d. "No extra charge will be allowed on account of *any change* that may be made during the progress of the work or before commencing same, either in the alignment, grade, slopes or dimensions of the road; the prices named in the contract are to be taken and considered as full compensation for all various kinds of work determined by their measurement *herein agreed upon to be performed*."

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*Resident Engineer Pennsylvania Railroad Tunnels (P. R. R., New York Extension).

e. "The work will be executed under the direction and constant supervision of the engineer of the Railway Co. . . . whose determination shall be conclusive to both parties."

f. "The company shall have the right to make any alterations that may be hereafter determined upon as necessary or desirable in the location, line, grade, plan, form or dimensions of the work, either before or after the commencement, *defining them in writing and by, or without, drawings*."

The italics in these clauses are the writer's and it will be seen at once that with the exception of the last sentence, which must have crept in inadvertently the contractor is wholly at the mercy of the chief engineer. How a contractor was to satisfy himself as to the location of the work (Par. b.), quantities of materials, etc., of a line which the chief engineer had the priviledge of shifting into the next county "at his pleasure" does not appear after a close study of the contract: and yet contractors (in this case experienced, up-to-date railroad contractors) are signing such contracts every day, and have to in order to stay in the business. It is greatly to the credit of the engineering profession that engineers construe these contracts as a rule in an equitable manner, so that contractors *do* stay in business, and what is more, are able to do work at reasonable prices, putting their faith and their capital blindly in the hands of the engineers in charge and seldom being disappointed. The writer however believes with Mr. Dennis, and most of the other members of the society who discussed his paper that it is time a more reasonable and equitable form of contract was drawn up, which while fully protecting the railroads, will give the contractor a show.

The line in question was through a mountainous country and was mostly side hill work. The evidence showed that numerous changes of the line were made during construction, even well along towards the end of the work, practically all of them in order to more nearly balance the quantities. These changes, almost invariably, as is generally the case, involved throwing the line into the hillside in the cuts so as to increase the excavation quantities. The contractor claimed that by so doing the percentage of rock was materially increased over the percentage he would have found on the original line and he demanded extra compensation therefor. The railroad company, or the chief engineer, apparently forgot all about the clause quoted in Par. f, and neglected to notify the contractor in writing or by drawings of any changes. This was rather surprising as such a provision is rather unusual. The chief engineer stated that the contract and specifications had been compiled from a number of old ones and it rather looked as if this clause had been copied with a number of others which are usually considered dead letters and had promptly been forgotten. It is usually the case that the contractor trusts to luck, that the engineer will forget to enforce the dead letter clauses rather than that the engineer will find himself tangled up through not having lived up to them.

The contractor testified that before submitting his bid, he had, as contractors usually do, talked over the terms of the contract with the chief engineer, especially in regard to Par. a, which specifically provided for widening cuttings to provide quantities for embankments, and was told he would not be required to borrow rock, but that rather than do so trestles would be built. This was denied by the chief engineer as regards building the trestles and as a matter of fact cuts *were* widened and rock *was* borrowed to make embankments where the contractor claimed he thought he would be allowed to trestle, and this of course increased the quantities of rock to be encountered over and above the amount he originally estimated.

It was claimed by the contractor that he was obliged to go back several times and take slices off the sides of some of the rock cuts in order to complete the adjacent embankments because the engineers had not made proper calculations of quantities. This was met by the engineers of the railroad company by testimony to the effect that, the cuts were not properly taken out to the full width in the first place, that the material in the embankments sloughed, etc., but none of the testimony in this regard on either side was backed up by definite records showing what was actually done.

Of course theoretically the contractor should have assumed that the embankments would be made solid, and that if so, judging from the character of the country, he would have to borrow solid rock to make them, as there was nothing else available; as previously pointed out, however, contractors in order to get work have to assume that the engineer will interpret the contract to a certain extent in their favor and make their bids accordingly; if the interpretation is not favorable they lose. The writer believes however that where an inspection of the plans, profiles, etc., seems to indicate that loose engineering methods are in force and that thorough and complete surveys have not been made contractors should be very wary of bidding on a no-classification basis; if they have to gamble it is better to do so under a classification contract.

The contractor, fortunately for himself, took the precaution to get a number of photographs, which showed fairly well the character of the material in some of the cuts, and were useful in proving that there was undoubtedly considerable rock on the upper side of them.

The railroad company produced no photographs and their records were not very complete owing probably to parsimony in the management. The regular progress profile showed the usual information with the exception of the exact distribution of quantities, the cross section sheets produced, showed nothing but the original surface line and the outlines of the cuttings or embankments as finally formed. If the monthly progress or the various stages of the work had been shown on these cross section sheets many disputed points might have been cleared up. No map of the line was produced and apparently the only means of telling what the various changes of alignment had been was to compare the alignment notes at the bottom of profiles of different dates.

The claim of the contractor was largely for compensation for increased quantities of material of a much higher classification than the general average he had in view when he bid on the work. He claimed that the actual final quantities were about 70% more than the excavation quantities shown on the profile on which he made his bid and that most of this increase was rock.

The railroad company's engineers showed that this profile showed embankment quantities in considerable excess of the excavation quantities and claimed that an experienced contractor would know that these quantities had to come from some place and that the final quantities were not greatly in excess (25% to 30%) of these embankment quantities, which latter being in excess showed the quantity of work to be done rather than the total excavation quantaties shown. The contractor as previously noted, claimed that he expected to trestle these embankments, where large excess fill quantities showed, if good borrow could not be obtained.

The original profile on which the contractor made his bid and on which the work was practically carried on, except for the various changes made, showed quantities in cuts and fills, the character of some of the structure at openings for waterways was indicated but no quantities of materials were given, and no detailed plans of any of these structures were available. The alignment was shown at the bottom, the names of right of way owners at the top and very little if anything else.

No attempt was made to indicate the distribution of materials, to estimate the amount of swell from cuts, of incidental quantities from ditches, or excavations for culverts or bridges; no indication was given as to changes necessary in highways or streams or amount of borrow necessary, and probable location of borrow pits.

It was evident, that probably owing to limitations of men, time, and money, a proper study of the location was not made before the contract was let, and that after it was, the engineers did their best to remedy the evident defects in the location as best they could, thus causing trouble and extra expense to the contractor and eventually to the railway company, as the arbitrators made a substantial award in favor of the contractor.

It is rather to be regretted that the various points of law involved were not brought up and settled before one of the higher courts. Of course the arbitarators in this case made an award without being obliged to state any of the reasons which led them to do so, and it was probably largely in the nature of a compromise.

One of the principal points brought out in regard to Par. e was as to the competency of the engineer. The courts have generally ruled that where the contract provides that "the decision of the engineer shall be final" it puts the responsibility on the party of the first part to provide an engineer who shall be competent to give a proper and impartial decision. The contractor sought to show in this case that owing to the numerous changes of line and the alleged great discrepancy between the original and final quantities, that the chief engineer was incompetent and that therefore his decision (as given in the final estimate) was subject to review.

The contractor also sought to show, that the fact that advertisements were inserted in the public press stating that the work was ready, and also in view of the clause (Par. b) that he had to satisfy himself as to the location, implied that the location was definitely made at the time the contract was let and that the changes made thereafter vitiated the contract. This probably had little effect on the minds of the arbitrators as no protest against carrying on the contract was made by the contractor, although he did protest that the classification was increased by reason of the changes of line, and against the directions of the engineers as to methods of doing the work.

Attention has already been called to the failure of the railroad company to comply with the provisions of Par. g. There were therefore apparently sufficient reasons for not holding either party to a strict legal interpretation of the contract and for settling the matter on an equitable basis of the actual value of the work done. The writer believes that a court of justice would have arrived at the same conclusion.

Among the points of interest which were brought out was the fact that no definite comprehensive scheme of distribution of quantities was made at any time by the engineers of the railroad. Apparently they only knew that some fills were largely in excess of the cuts available to make them, and that therefore there would be borrow from somewhere. No test pits were made to determine the nature of any of the material on the line, or to locate suitable material for borrow; no estimate was made as to amount of swell, etc., and it seemed quite probable that the statement of the contractors that they had to go back several times in cuts after they had once taken them through, in order to get more quantities for fills was correct.

Owing probably to an insufficient engineering force, the work was not completely cross-sectioned until long after the excavation was started and no attempt was made to figure the quantities from the cross-sections until the work was well under way. On railroads with a properly organized engineering staff it is customary to have the whole work cross-sectioned and quantities calculated within a few weeks after starting work. It should be possible to give a very close estimate of the swell or shrinkage soon after the work has been opened up, and with this information the amount of borrow necessary ought to be very closely approximated and this information given to the contractor. It is not just to a contractor to leave decisions as to distribution of material open any longer than is absolutely necessary as he cannot possibly organize his forces or determine what plant is necessary until this is done.

The writer is sure that provided the work is properly done, the main questions of distribution can be settled when the final location is made, in fact a proper final location cannot be made until these questions are settled more or less definitely.

The form used for the monthly estimates on this work showed only total quantities paid for in each mile or section. A proper form should show the quantities allowed in each cut, for all ditches separately, for borrow pits, and for excavations for all structures, so that the contractor may know what he is doing. A provision is made that claims for extra work should be made within a certain time. If the contractor is not given the necessary detailed information as to what he is paid for each month he cannot tell whether he has been paid for certain work done or not. The details of the quantities of all kinds, and methods of calculation, should always be available for the contractor's use if required.

While it is true, as the writer has stated elsewhere*, that no line can be so well located that revisions cannot be made to advantage, these should not be made at the expense of the contractor after he has started work. Where a contract is let on a no-classification basis, sufficient study should be made of the location before bids are asked for so that it can be assumed to be reasonably nearly correct, if after this is done changes are still found to be advisable for the best interests of the company, provision should be made in the contract so that this unforeseen work will be paid for on an equitable basis to both the contractor and R. R. Company.

Nearly all disputes in relation to contracts which provide for classification of materials arise from differences of judgment in regard to the classification, which differences are nearly always difficult of adjustment after the work is completed. The case herein cited is fairly typical of the disputes that may be expected in regard to a no-classification contract. It may be noted that the contractor makes no claims whatever on account of the excavation on the original line being more expensive than was anticipated when the contract was let, whether it was so or not, but almost solely on account of the changes of line changing tne conditions under which the contract was awarded. It seems to the writer that disputes which arise from the interpretation of a contract on the no-classification basis can be almost wholly avoided by proper engineering methods and a proper form of contract. Whereas those relating to classification will always arise from the different judgments of different men. There ought to be no question of course that proper and efficient engineering metnods should be used in any case, but it is not always that the powers who provide the money can be made to realize this and when they do not they generally pay more in the long run for the work than they save on engineering.

The writer believes it is the general impression that by resorting to arbitration, much of the delay, expense, and the red tape involved in the courts of law may be avoided, though he believes the contrary is the case. The proceedings before the arbitrators are conducted by counsel for both sides and material as well as expert witnesses are called and examined under the regular "rules of evidence." The expense is certainly no less and unless previously agreed to by both parties, the award is not binding. A much more expeditious and equitable method of adjusting such disputes would be, the writer believes, to chose some one thoroughly competent engineer satisfactory to both parties to decide the questions at issue.

Three steam shovels together in the iron-ore deposits in Mesabe Range, Minnesota, have made a maximum record of 190,000 cu. yds. in a month, a rate of 1,220 cu. yds. per shovel in 10 hours. The average performance, however, is about 900 cu. yds. per 10-hour day.

The first asphalt pavement in Milan, Italy, according to a recent consular report, was laid in 1897, in one of the minor streets, taking the place of wood. The following figures show the great increase of this paving in Milan in recent years: 1901, 9,871 sq. ft.; 1904, 82,302 sq. ft.; 1906, 301,349 sq. ft. The asphalt used is of Italian preparation. Trolley tracks on asphalted streets in Milan are supported on either side by small wooden blocks, measuring 2¾ by 3 15-16 by 8⅝ ins. These blocks save the asphalt greatly, and in the future when trolley tracks are laid on asphalted streets in Milan, or in fact in all Italy, these blocks will be used. They are now imported from one Australian firm.

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*P. 101 of Railroad Location, Surveys and Estimates. Published by Myron C. Clark Pub. Co., Chicago, Ill., at $3.00.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Florida East Coast Railway—Key West Extension.

BY HOWARD EGLESTON, C. E.*

IV—CONCRETE CONSTRUCTION.

Aside from the viaduct at Long Key there has been no noteworthy concrete work done on the line, a central pier and two abutments at Jewfish Creek, abutments for 25 ft. bridges at Tavenier Creek, Snake Creek and Windley's Passage, and central pier and abutments for Indian Key drawbridge, making up the list between Homestead and Long Key. Strange as it may seem, but in keeping with the general plan of work, no mechanical mixers were used at any of these places, all concrete being mixed by hand and deposited by wheelbarrows. This has, of course, retarded the work considerably.

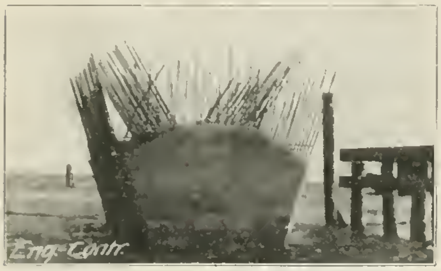

Fig. 1—Standard Pier.
(Steel reinforcing shown is continued into arches. Piles with cap at right are for support of arch falsework.)

Work on the Long Key Viaduct was begun in the spring of 1906 and continued till the hurricane of Oct. 18th destroyed a large portion of the plant and a considerable part of the unfinished work. At this time there were eight or nine piers finished, no arches had been set. Little, if anything, was done on the viaduct after this storm until the latter part of November, when the work of setting the falsework for arches Nos. 3-4 4-5 and 5-6 was begun. The work of placing the concrete for arches was begun under the personal direction of Mr. W. M. Venable, the engineer in charge. Owing, I suppose, to a lack of experience in such work, quite a number of pieces of timber used to support the steel reinforcement were left in the forms and had to be dug out or plastered over when the forms were removed. I do not know of any similar blunders being made subsequently. Work has progressed steadily all through this year, on both piers and arches, most of the time a double gang has been used and the work continued day and night. The result being on August 1, 98 arches and 116 piers completed.

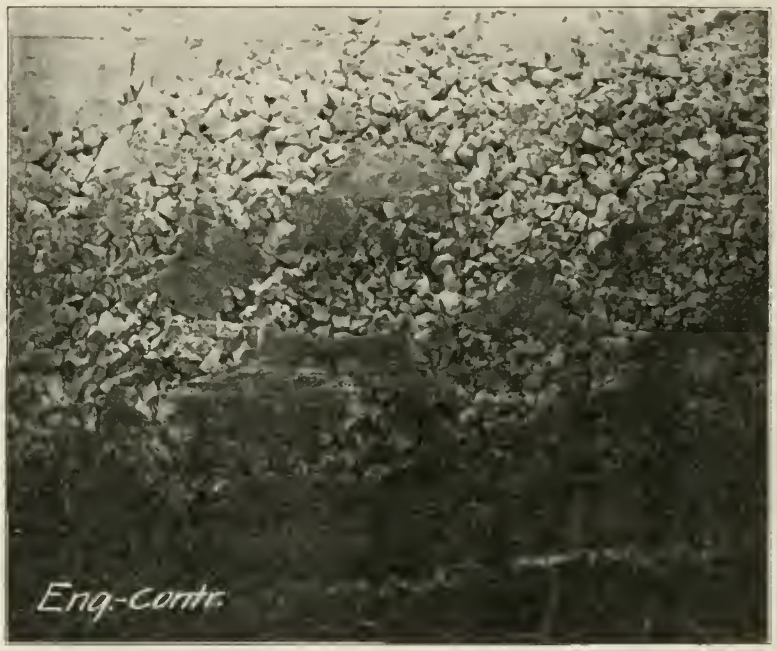

Fig. 2—Photograph of Concrete, Long Key Viaduct.
(The concrete was not all like this, but places like this occur frequently as shown in Fig. 3.)

In constructing this viaduct, groups of piles (yellow pine) 18 to 28' in number, are driven at proper location for pier, also there are driven down on each side of the pier 5 piles, to be used later to support the false work for the arch, and at each corner a pile for a fender, making in all 32 to 42 piles for each pier. The central piles are cut off about 2 ft. below mean low water, the coffer-dam is lowered over them and anchored securely to the bottom by means of screw jacks fastened to the four fender piles at the corner. The sand, silt or gravel at the bottom of the coffer-dam is then pumped out and the concrete seal deposited in the bottom of the coffer-dam. For a long time great trouble was experienced in getting a tight seal; apparently there was no one in charge of the work who had a thorough knowledge of handling concrete. Again and again it was found.

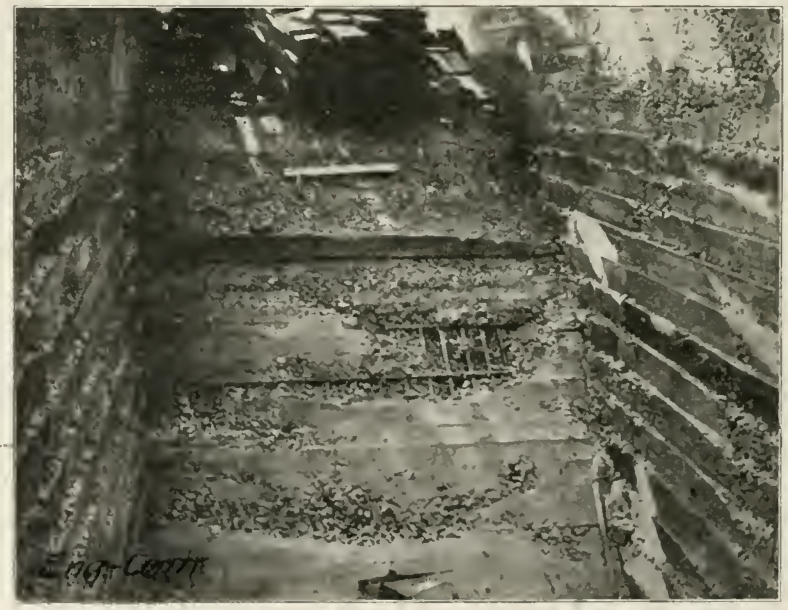

Fig. 3—Photograph of Concrete, Long Key Viaduct.
(This was not an exceptionally bad specimen. Much of the work when uncovered showed up like this.)

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*Chattanooga, Tenn.

when an attempt to pump out the coffer-dam was made, that the seal was not tight and that it was impossible to empty the coffer-dam on sending a diver down to examine the bottom. We found in places, bushels of clean gravel where concrete was supposed to be. In many cases several attempts were made before a tight seal was secured. The cause of this trouble was the ignorant handling of a very simple apparatus, which consisted of a hopper and two pieces of 10-in. diameter sheet iron pipe, the lower piece slipping over the upper one, so that it could be raised or lowered at will.

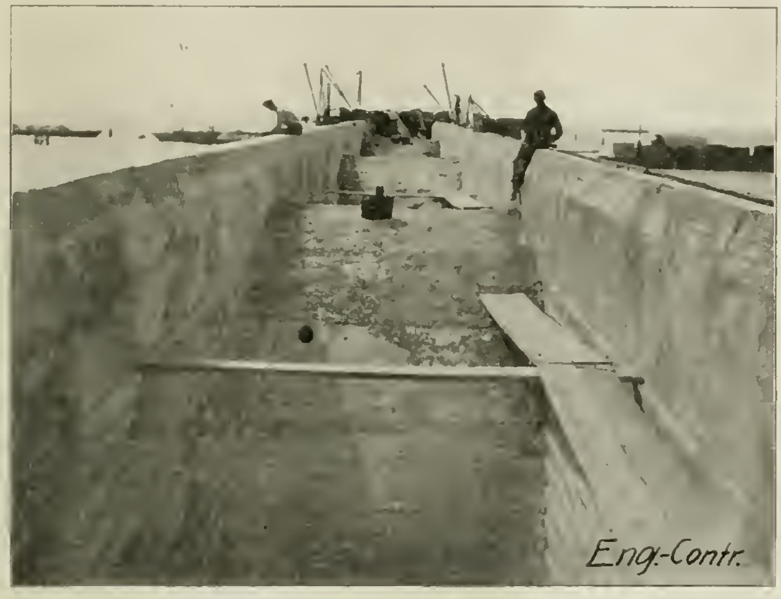


Fig. 4—Inside View of Viaduct after Concrete Had Been Surfaced. (This gives an idea of the distance the concrete fell. It left the bucket on a level with top of parapet wall.)

When the work of sealing began, this tube was lowered to the bottom of the coffer-dam, and the concrete when dropped by a bucket into the hopper, the tube being full of water, had, of course, to pass through 10 ft. or more of water before reaching the bottom, the distance growing less as the tube filled up. The gravel could hardly fail to be well washed by this process. When the tube was full it was raised slightly and moved about so as to let the concrete escape at the bottom. Through ignorance of the workmen, who were common laborers, the tube was often lifted so high or moved so far as to empty itself, and, of course, the washing process was repeated. A tremie, having a gate at the bottom was suggested to the engineer in charge and finally permission was given to build one of wood as a trial. This was clumsy and heavy, but it gave better results. Being made of 2-in. stuff, it displaced a good deal of water and when raised to discharge the concrete, a strong suction was caused, making it impossible to deposit the concrete as quietly as desired. A requisition was then made on the constructing engineer for some steel tremies of suitable size to lower among the piles, with doors on the bottom by which the concrete could be discharged, but I think they were never furnished. Alterations were made in the platform that supported the hopper, and the hopper and tubes were enlarged. Also, instead of dumping a bucketful of concrete in the hopper it was dumped on the platform and shoveled into the hopper by hand. This has given better results, but of course there has to be a time, at least once in the construction of each pier, when the concerte is shoveled into the tubes when full of water; if this lot of washed gravel is spread over the bottom, it may be entirely covered up by the 2 ft. of concrete used for the seal, but this arrangement for depositing concrete under water is not reliable.

After three or four days the coffer-dam is pumped out and the pier form set up inside, twisted steel bars are wired in place and the concrete dropped in to sift itself down through the reinforcement and piles, these making a "riddle" which tends largely to separate the aggregates. It was the intention of Mr. Geo. P. Carver, who designed this work, to deposit the concrete in the piers through a tube, but he resigned before this part was started, and his plan was not carried out. Figure 1 shows what a mass of steel rods the concrete was compelled to pass through. The concrete in the seals was a 1:2:4 gravel mixture, after coming from the mixer it was placed on the deck of a barge and allowed to set from one-half to one hour before being lowered into the water. The concrete used for the piers was a 1:1½:4 gravel mixture. A medium wet mixture was specified but the concrete turned out varied greatly and was generally too dry to settle around the reinforcement properly; very little attention was given to thoroughly tamping the concrete. Sea water was used in the pier work and, I believe, finally on all the work.

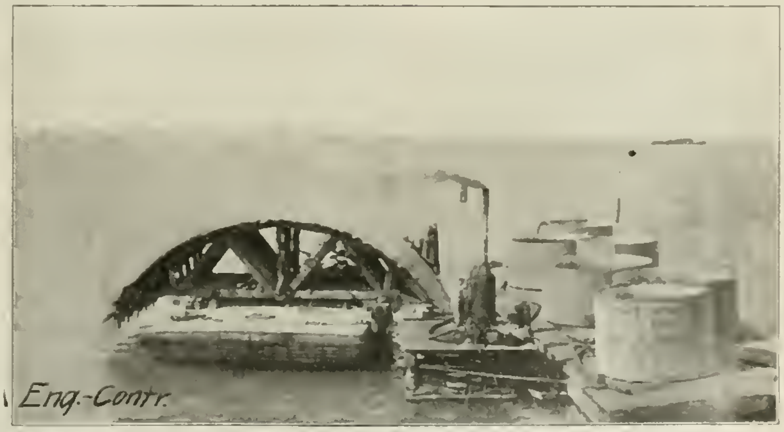


Fig. 5—Barge and Pump Outfit Used for Moving and Setting Arch False Work.

After the coffer-dam and piers form had been removed, the arch falsework was placed on the piles provided for this purpose, the spandrel wall forms erected, and the reinforcing steel wired in place. The concrete was mixed on the work barge which floated alongside, and was hoisted in a clam sheil bucket from deck of barge to top of viaduct. The inside of the forms being so full of timber bracing and steel reinforcement that it was impossible to lower the bucket into the form, the concrete was dropped from the level of parapet to the bottom of the forms, the mass of it, at the haunches and on top of the piers, falling 18 to 20 ft. or more. Of course this would tend to separate the aggregates even if there were no obstructions, and when falling through such a mass of timbers and steel rods the condition of the concrete must inevitably have been as shown in Figs. 2 and 3.

It was intended that a wet mixture should be used in the arch work, but as the forms had not been made tight there was a great amount of leakage and the mixture was ordered changed to a medium dry one, which, of course, could not be properly tamped around the steel reinforcement, situated as it was at the bottom of such a mass of timber braces. By keeping masons constantly at work the concrete was faced up and made to look as shown by Fig. 4, but when the molds were first taken off it was pretty tough looking work.

When the concrete in an arch has stood long enough, a derrick barge is floated alongside and the sections of the spandrel form are taken down and laid on the barge. Next a barge, with pumping barge attached, as shown in Fig. 5, is floated under the arch, and, after blocking has been placed so as to support the arch falsework, a sufficient amount of water is pumped out of the barge to raise it so as to take the weight of the falsework off from the supports on each side of the piers. When this has been done, and the supporting wedges removed, water is let into the hold of the barge 'till it sinks sufficiently to allow the falsework to clear the concrete, the barge is then towed to where the next arch is to be placed, pumped out so as to raise the arch falsework sufficiently to place it on the timbers intended for its support, and then adjusted to exact height by means of oak wedges.

When the arch falsework has been set properly, the derrick barge loaded with sections of spandrel forms is towed alongside, the forms set up and securely braced.

The work on this viaduct has gone very slowly, and the entire situation there has been most unfortunate. From the very first there has been such a conflict of authority as to militate seriously against any satisfactory results, and since the set-back which the work received from the hurricane there has been such an incessant demand for haste, that the quality of the work has been sacrificed for quantity, a thing which should never be permitted in concrete construction.

Methods and Cost of Constructing Hurdles for Closing Breaks in River Bank.

BY F. Y. PARKER.*

An upstream extension of the bank protection at Sawyer Bend, St. Louis, Mo., was made in the fall of 1905 under the plan of improving the Mississippi River between the Ohio and Missouri rivers. Less than one-fourth of a mile from the bank and parallel to the river at this place is a small stream, Maline Creek. Between the creek and the protective work the Chicago, Burlington & Quincy Ry. passes on an embankment that has a single opening through it—a roadway opposite the new work. The night before the work was to have been commenced an overbank flood from the creek poured down the road and over the river bank, forming a number of serrated pockets, varying in width from 50 ft. to 200 ft., in length from 25 ft. to 350 ft. and in depth from 10 ft. to 15 ft. A bar was also formed extending 50 ft. from the mouth of the pocket to be described into the channel.

To insure the safety of the protection, in front of the serrations, the five largest pockets were closed by hurdles as shown by the accompanying cut. Across the mouth of each pocket a single row of 31-ft. piles was jetted 14 ft. into the ground, stringers were hung and stone dikes 4 ft. high were placed along the hurdle lines.

Operations were begun by mooring a steam pile driver and a barge of piles opposite a pocket. A pile was prepared on the barge for jetting by sharpening its butt to an obtuse point; the log chain was then attached and by means of the pile line and suitable tackle the pile was dragged to its position on the hurdle line marked by a shallow hole. Guy lines were now attached and the pile was up-ended. This operation was repeated for each pile.

The nozzle of the jet pipe was placed in the hole and the pipe held against the pile; jetting was now begun and at the same time both pile and pipe were moved slowly to and fro to facilitate settlement.

The jet pump was a No. 12 Hooker, 16-in. stroke and 55 strokes per minute. It was placed in the cabin of the driver and securely bolted to the deck. A 2½-in. gas pipe connected to the discharge, passed under the crab machinery to the foot of the ladder, where 30-ft. sections of six-ply rubber hose were connected to it. The jet pipe with 2-ft. nozzle and 1-in. vent was connected to the hose by a T.

In this work 61 piles were jetted, 15 stringers were hung, 185 cu. yds. of stone placed and 1,700 sq. ft. of curtains built. The cost of the work was as follows:

Materials:	
Nails	$ 2.50
Spikes	2.00
Wire	2.20
Lumber	14.02
Piles	235.46
Stone	101.25
Miscellaneous materials	1.80
Total	$359.23
Supplies, etc.:	
Coal	$ 3.15
Subsistence	42.32
Total	$45.47
Labor:	
1 foreman, 12 days, at $75 per month	$ 30.00
1 engine man, 12 days, at $60 per month	24.00
5 boatmen, 12 days, at $35 per month	70.00
2 laborers, 14 days, at $1.12	31.00
Total	$155.00
Grand total	$559.70

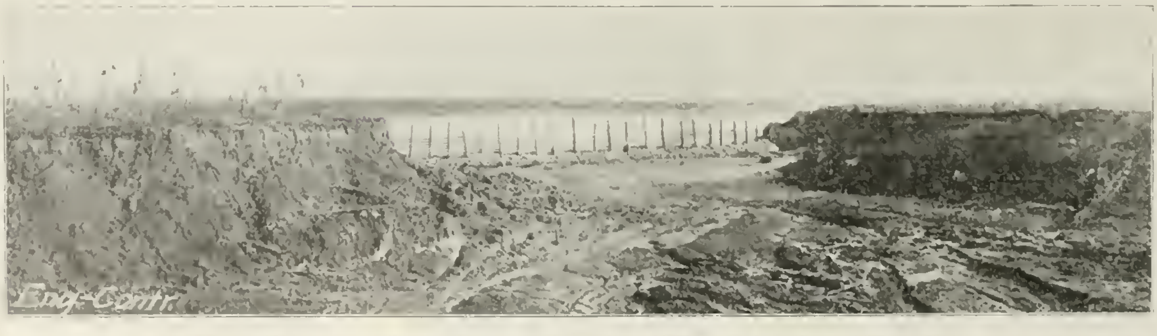
The two laborers were employed all the time placing stone in the dikes; they placed 156 cu. yds. at a cost of $31, or of 20 cts. per cubic yard. The other labor was divided as follows:

7 men, 10 days, sinking piles	$103.30
7 men, 1½ days, hanging stringers	15.49
7 men ½ day constructing curtains	5.16

The cost of sinking piles was thus $1.70 per pile; adding the cost of pile $235.46÷61=$3.86 we get the cost of piles in place as $5.56. The cost of hanging the stringers was $15.49÷15=$1 about per stringer. The 1,700 sq. ft. of curtain cost $5.16÷1,700=0.3 ct. per square foot.

The time represents the actual time worked in days of 8 hours, and the cost of labor is for this time alone and does not include two Sundays. No time was lost on account of rain or accidents.

An examination of the work in 1907 shows the hurdles, curtains and dikes to be in excellent condition, with a fill in the pockets of over 4 ft.



View Showing Arrangement of Hurdles for Closing Break in River Bank.

The total production of silver in the United States during 1906 is estimated at 56,517,900 fine ounces, of a commercial value of $38,256,400.

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*U. S. Assistant Engineer, Custom House, St. Louis, Mo.

Methods and Costs; Some Old; Some New.

Protective Paint. — The following formulas for asphalt paint were given in the report of the Committee on Preservatives for Wood and Metal at the recent convention of the Association of Railway Superintendents or Bridges and Buildings:

Asphalt Paint No. 1.

72 lbs. "C" asphaltum.
22 lbs. rosin.
2 gals. boiled linseed oil.
2 gals. turpentine.
10 gals. 63° benzine or gasoline.

Melt asphaltum and rosin at 400° F. Keep at this temperature; after foaming ceases, add oil gradually, stirring after oil is added. Draw fire and cool down to 200° F. and add turpentine and benzine.

Asphalt Paint No. 2.

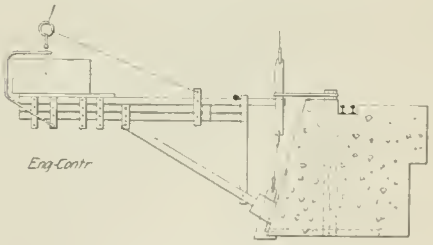
25 lbs. "C" asphaltum.
2½ lbs. rosin.
6 pints boiled linseed oil.
6 pints 63° gasoline.

Mix same as No. 1. If you don't care for quick drying qualities, use engine distillate instead of 63° gasoline. Where a dip is to be used, use "D" asphaltum at 350° F. The formulas are stated to have been used on the Pacific Coast, to some extent, both on wood and metal, with fairly good results.

Lowering Timber Into a Caisson.—In the construction of wing walls for a dock a floating caisson was used in the sawing off of the piles and in the placing of the caps and grillage timbers. In taking the pile caps and grillage timbers into the working chamber, a timber lowering arrangement was used. This consisted of a pair of vertical ways attached to the side of the caisson and extending down to the cutting edge of the working chamber. A sprocket wheel was placed at the top and bottom of each of these ways and a link-belt sprocket chain operated on each vertical pair of sprockets. The chains were 7 ft. apart and a bracket was attached to each chain at the same level, the horizontal arms of the brackets being placed down. The brackets were fitted with a pair of small spikes to prevent the timber from slipping. When the chain was moved the brackets were lowered and the timber submerged, and as the brackets passed around the lower sprocket wheel, they delivered the timber under the cutting edge of the caisson into the working chamber. In this way the timbers used in the underwater work could be taken into the chamber in 7 ft. to 28 ft. lengths, and all difficulty of passing them through the locks was avoided. The vertical timber ways were placed out a little from the side of the caisson so that proper adjustment of the sprockets and chains at the bottom along the cutting edge could be secured.

Securing Working Faces in a Quarry by Air Pressure.—Compressed air has been used to good advantage in quarry work in securing working faces. In the case in mind the quarry was located on a hill, sloping at a slight angle, and consisted of a solid homogeneous mass of moderately hard granite, which split readily on a straight line in almost any direction, and showed no bed planes or ledges. By means of air pressure large sheets of the granite were separated from the mass and then broken up for various purposes. In separating these planes a drill hole 2 or 3 ins. in diameter was sunk to a depth of 6 or 8 ft., depending on the thickness of the desired stone. The bottom of this drill hole was then sprung with a half stick of dynamite, after which a handful of black powder was exploded in the pocket, starting a horizontal cleavage crack across its greater diameter. This was followed by still more charges of increasing quantity until the line of cleavage had been extended to a radius of about 100 ft. in all directions. It usually took about two or three weeks' time to extend the line of cleavage to this point by means of powder. After the cleavage had been extended to a radius of about 100 ft., a pipe with a globe valve was cemented into the drill hole and connected to an air compressor. Air at a pressure of 70 or 80 lbs. was then turned on, care being taken to admit the pressure gradually so that cleavage would not be brought abruptly to the surface. As the air was admitted into the drill hole it gradually extended the line of cleavage until it came to the surface at the slope of the hill. A sheet of several acres in extent, having an approximately horizontal bed plane, has been separated in this way, the line of cleavage being extended to a radius of 225 ft. in about half an hour by air pressure.

Placing Concrete Blocks in a Breakwater.—In making repairs to a breakwater large blocks of concrete were used to replace the old granite courses. The breakwater consisted of a huge mound of large and small rubble surmounted by a superstructure of coursed and rubble masonry. The five lower courses of the superstructure consisted of granite blocks backed by concrete blocks. A storm caused a cavity 35 ft. long by 6 ft. high and 6 ft. deep in the third and fourth granite courses, and this cavity was filled in by six concrete blocks of the section shown in the cut, the two end blocks being cast with right and left-handed shoulders respectively, in order to break joints with the old remaining granite courses. The concrete blocks weighed 12 tons and were made of 1 part Portland cement mortar to 8 parts of sand and rubble, and faced with hand spolls. They were cast with a square indent, about 2 ins. deep, in the lower bed joint, which, when filled with Portland cement mortar, passed from above low water through the vertical hole left by the portable lewis bar, becomes set to the old course below. A square channel was also left along the top in which old rails extending from block to block were placed; V-shaped vertical indents were also provided on each side. The plant used in placing the blocks consisted of a 5-ton steam crane with a long jib, a 12-ton steam crane and a guide suspended from the coping of the wall to prevent the blocks catching in the steppings of the masonry in their descent. The balance weight shown in the cut, which also shows section of the concrete blocks, was used to get the blocks into position in the wall. This balance weight consisted of a beam, about 10 ft. long, formed of old rails and square iron bars, having a small iron platform at one end, of which a ½-ton weight was secured, and at the other end a flat bar, about 3 ft. long, working on a center in a pair of stout jaws, to which was attached a short chain with a stout iron hook. A wooden cross-beam also butted against the foot of the block and was held in position by two flat iron struts attached to the main beam. The iron hook was placed in the square indent at the toe of the battered face of the block, and the swinging bar, to which it was attached, was secured by a chain and link to the top of an iron rail placed vertically in the hole left by the lifting lewis bar. The wooden block was butted against the face of the blocks, and the whole lifted by the 12-ton crane attached to the large link at the top of the swinging bar, and swung into position. The 5-ton crane with the long jib assisted by controlling the chains by which the actual balance weight at the end was raised or lowered.



Balance Weight.

Tanks made of reinforced concrete and lined with pieces of glass 12 by 24 centimeters cemented together are in general use among the merchants of Algiers for holding wine, oil and alcohol. The capacity of the tanks in general use ranges from 500 to 5,000 hectoliters.

LETTERS TO THE EDITORS.

Macadam Road Construction in Massachusetts.

Sirs: The article* on macadam roads by Mr. A. L. Valentine leads me to describe the methods used by one of the successful contractors in Massachusetts.

If the road is nearly level a beginning is made 1,000 feet from the crusher; if hilly then at the top of hill nearest 1,000 feet from the crusher.

The road is then finished towards the crusher, so at no time do the teams pull through more than 1,000 feet of unfinished road and the roller is beyond them and out of the way.

On completion, the road is then started 2,000 feet away; then 3,000 feet away, and so on, working towards the crusher in each case.

By this method loads varying from three to four tons are conveyed easily and every load acts as a roller so that when the last ton of stone is on the road, the rolling is done except a few feet in the last section.

By compelling the teamsters to keep to the right one day, to the left the next day, and so on, the road does not rut, but soon is consolidated all over. In the last thirteen years, where a road has been built this way, I have not known of a case where the macadam has "picked up" or where a contractor has been required to reroll a section built in this manner.

Yours truly,
D. H. Winslow,
Resident Engineer Massachusetts Highway Commission.
Dorchester, Mass.

Voids in Rock Blasted Under Water.

Sirs: In Dredge Section 2 of the Ashtabula Dock Extension, Lake Shore & Michigan Southern Ry., which has just been finished by the Lake Erie Dredging Co. of Buffalo, the rock dredged was paid for by place measurement, there being 62,869 cu. yds. of rock so measured in this section. This was determined by careful soundings taken 6 ft. apart on ranges which were parallel lines spaced 6 ft. apart, both before and after dredging. The material dredged was shale rock which had been drilled and blasted, and which, after being dumped into scows, averaged about 25 lbs. per piece, in size.

Payments were made monthly and it was found impracticable to make place measurements each month on account of the large amount of floating plant engaged on the dock extension, which was in the way, and the often rough condition of Lake Erie. It was, therefore, decided to measure the material in scows and take a certain percent of this as place measure until the final estimate when the total amount of material in this section would be determined by soundings taken before and after dredging. The sum of all partial payments previously made would then be subtraced from the above total, giving the amount of the final estimate.

The total amount dredged as measured in scows was 103,537 cu. yds. The amount of voids in the rock was therefore, 100 — (62,869 + 103,537) or 39.3 per cent. Excavation was paid for 6 ins. below the required grade and no excavation was found by the soundings to have been carried below this level, which was 21.5 ft. below lake level.

A large amount of this material was used below water for filling the cribs forming the sub-structure of the docks and it was found to pack down very solidly. When exposed to air, however, it disintegrates rapidly. Yours truly,

E. C. Bowen, Jr., Assistant Engineer,
L. S. & M. S. Ry. Co.
Ashtabula Harbor, O.

The Cost of the Pinto Pressure Pipe Line and Day Labor Work by the U. S. Reclamation Service.

Sirs:—In the issue for September 18 of "Engineering Contracting" occurs an editorial regarding force account and contract work by the Reclamation Service, which contains some very good advice, and the friendly tone of which is greatly appreciated. The first paragraph, however, contains some statements and deductions which indicate an erroneous impression regarding the work carried on by day labor in the Reclamation Service. For instance, you say:

"The work is proving no exception to the general rule that it costs the government far more than it would cost the contractor to build a structure."

In proof of which reference is made to the

"Extremely high cost of the reinforced pipe in Arizona by the forces of the Reclamation Service."

The labor cost of $5.98 per cu. yd. for the reinforced concrete pipe is cited as proof of the above conclusions. The conclusions are hardly justified by the data, for the labor cost on that kind of work is really a remarkable piece of first-class and very cheap construction. The walls of the pressure pipe are very thin, requiring very difficult and delicate building and handling of forms and difficult tamping and contain much complicated steel reinforcement. Labor cost on such work is necessarily very high, as might be inferred from the character of the work and, according to your own standard, as proved by the bids of contractors. On six different structures of this character bids have been received by the Reclamation Service within the past fourteen months. In every case the Government was to furnish steel for reinforcement and cement, so that the prices bid are directly comparable with the price of $5.98 above quoted. The bids received are as follows:

Williston project, August 30, 1906—the only bid received—was $13 per cu. yd.

Buford-Trenton project, March 5, 1907—$11.50.

Sun River project, April 3, 1907—the only bid received, was $27.50 per cu. yd.

Belle Fourche project, April 10, 1907—the only bid received was $19.50.

Belle Fourche project, June 10, 1907:
Schedule 1; $13.50, $16.00, $17.00.
Schedule 2; $16.00, $16.50, $18.00.

Reinforced concrete pipe for obvious reasons may be considered the most difficult type of this class of construction, but to show that these high bids are not confined to this type, and further, that thin walls of reinforced concrete always cost much more than massive walls of concrete, I beg to quote the bids received by the Reclamation Service for plain and reinforced concrete:

State.	Project.	Date.	Features.	Unit.	Quantity.	Plain.	Reinforced.
Neb.......	North Platte.....	6-2-07	Structures, Sch. 2...	c. y.	235		$16.50
N. Dakota.			Abutments..........	c. y.	260	$12.90	
N. Dakota.	Buford-Trenton..	3-5-07	Canal structures......	c. y.	110		13.00
					40	9 00	
S. Dakota..	Belle Fourche....	4-10-07	Weirs, Culverts.....	c. y.	200		22.00
Wyoming..	Shoshone........	8-23-06	Structures, Garland Canal, Sch. 3......	c. y.	1100		15.00‡

‡ In addition to this price a bid of 3 cents per pound was submitted for placing the steel.

In addition to this price a bid of 3 cents per pound was submitted for placing the steel.

Conditions on the Salt River project regarding labor and difficulty of access are fully as unfavorable as any of the above projects, and more so than some.

If any reliable contractor will agree to do this class of work as cheaply as the Reclamation Service does it, plus a reasonable profit, the only requirement is that he shall submit a bid.

The Reclamation Service has undertaken work by day labor only when forced to, either by the failure of the contractors, failure to secure reasonable bids from reliable firms or some peculiar circumstance which forbids doing the work by contract. The method of letting small contracts suggested in your editorial has been successfully tried in various places and large numbers of small contractors are now doing excavation work in Nebraska, South Dakota, Washington, Oregon and other localities. The class of men who take subcontracts from large firms are sometimes very efficient and desirable contractors, but find difficulty in meeting the requirements of the statute that they shall give a bond, which is not required when they take a sub-contract. Furthermore, contractors usually advance the funds and supplies with which the sub-contractor carries on his work, which of course, could not be legally done by the government.

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*Engineering-Contracting, Oct. 2, 1907.

I personally feel entirely certain that no engineer in the Reclamation Service is guilty of the implication in the last paragraph of your editorial of attempting to acquire experience at his client's expense.

Within the past few years, few, if any, eastern contractors have been willing to bid on western work on account of plenty of profitable work nearer home. The activity of railway extension, power construction, and the destruction of San Francisco have offered lucrative employment to all of the regular large western contractors so that few bids could be received from such firms. Consequently, many inexperienced men have entered the contracting field, but even these recent bids are very few and very high. The cases are numerous in the Reclamation Service where, on small contracts, high bids have been rejected and the work done by day labor from 20 to 35 per cent less than the lowest bid.

Very truly yours,
Arthur P. Davis,
Chief Engineer U. S.
Reclamation Service, Washington, D. C.,
Oct. 22, 1907.

[Editorial comment upon our correspondent's letter will be found elsewhere. —Editor.]

The Sweeping of Factories, Warehouses and Other Large Floor Areas.

The old hand broom is still used in the sweeping of rough board floors, as well as smooth floors, in spite of the fact that a mechanical sweeper does the work in far less time and without raising dust. The sweeping of large exposition buildings, such as those at St. Louis and at Jamestown, causes such a great expense when done with an ordinary broom that the use of a mechanical sweeper becomes almost imperative. The Jamestown Exposition buildings are being swept by a machine that was also used successfully on the 60 St. Louis Exposition buildings and surrounding grounds. The machine sweeps a space 30 inches wide, as fast as the operator can walk. The dust and debris are picked up by a rotating broom and deposited in a dust receptacle, and, in this manner, one man easily does the work of four men using brooms. This mechanical sweeper for floors, streets, etc., is made by J. S. Baron, 127 Franklin street, New York City.

Belgium produces about 24,000,000 tons of coal per year, valued at $58,320,000.

Engineers' Contracts and Specifications from a Contractor's Point of View.*

BY JAMES W. ROLLINS, JR.†

(Discussion continued from Oct. 30 issue.)

Mr. Charles R. Gow: It is probably no exaggeration to say that this disposition to, in a sense, take advantage of the contractor by the shrewd wording of the text and skillful evasion of responsibility has been the cause of more dishonesty on the part of contractors than any other single reason.

How often we have heard our engineer friends condemn, with righteous indignation, the habit of the contractor who studies the contract and specification for some loophole or omission through which he may legitimately claim additional compensation or relief from onerous requirements. How often also have we seen the same engineer, when he discovers that he has failed to foresee and provide for some contingency which has arisen, take refuge behind some blanket clause, which never contemplated this particular contingency when it was written. Are not the two traits identical? The contractor seeks to safeguard his pocketbook and the engineer his reputation as a farseeing and shrewd official.

I agree with Mr. Rollins that the greatest absurdity that exists in present-day contracts, from the standpoint of fair play, is the clause making the engineer sole arbitrator in cases of dispute.

Not only are we obliged to accept the engineer as referee, but in addition must agree that our methods, men and materials will be acceptable to him, and that he shall finally decide whether or not we are entitled to any compensation, and if so, what amount. Can you not imagine that under these conditions the personality of the engineer will enter largely into our estimates of costs? Some engineers we do not care to work for under any circumstances.

As to the specifying by the engineer of the detailed methods of operations, my opinion is entirely in accord with that of Mr. Rollins. I fully believe any unbiased individual will admit that the average contractor is a far better judge of the proper methods to obtain desired results than is the average engineer, yet a majority of the engineers seem impressed with the idea that their technical knowledge entitles them to the privilege of directing the contractor in the management of the details of his business.

As an example, I was once consulted by a prominent engineer as to the proper procedure in a matter of which this engineer had no previous experience. He requested my opinion on account of certain successes I had made in the class of work under discussion. Subsequently he embodied in his specification the general method outlined by me, but in addition also his own conception of the detailed manner of carrying on the work, a conception which, by the way, was erroneous. It so happened that I was the successful bidder, and much to my surprise and disgust was obliged to follow out his ideas in spite of my protest, with extremely unsatisfactory results both to the engineer and myself.

Another habit which is growing among contract writers is that of specifying prices for certain items. While I can see no good reason for usurping this one of the few contractors' privileges, there would be no serious objection to this habit if the engineer would commit himself definitely as to the probable quantity involved. I have never known an engineer to specify an excessive price for any of these items, and usually the contractor prays that there may be no work of this classification if he must accept the price set.

On a certain contract executed by our firm, a price of $13 per thousand was stipulated for sheeting left in place. No estimate was given of the probable quantity to be used, but it seemed likely that the amount would be inconsiderable. On the contrary, there were 150,000 board ft. so left in place, costing us for the lumber alone $22 per thousand, and representing a loss to us of $1,350 outside the labor cost. A protest to the engineer against this arbitrary allowance on so large an amount was met by the argument that we should have taken it into account in making up our bid; but how could it be considered in the bid when the amount to be used was absolutely unknown?

Still another matter which oftentimes causes unnecessary annoyance and hardship to the contractor is the tendency of engineers to retain all of the contractor's money that their consciences will allow. The general rule appears to be, "In cases of doubt, hold back enough."

First we are required to furnish a bond of from 20 to 50 per cent of the amount of the contract. Next a reserve is retained of from 15 to 25 per cent of our monthly estimate. Before the allowed estimate becomes payable to the contractor, from one to three weeks' additional work has been completed and forms an additional security to the owner.

It would appear to an ordinary individual that the above items would amply secure the owner against any breach of contract on our part. The average engineer, however, takes a different view of the matter, his idea of an approximate estimate being one that is well on the side of safety, for why should the contractor complain when he knows that he is to receive the remainder upon the completion of his contract some months hence? Meanwhile the contractor must pay 100 per cent of his pay roll every Saturday night, and if his material bills remain unpaid after thirty days, the various credit agencies are investigating his financial condition.

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*Abstract of paper read before the Boston Society of Civil Engineers, published in Journal Association of Engineering Society. Our abstract is about one-fourth of original paper and discussion.

†President, Holbrook, Cabot & Rollins Co., Contractors, Boston, Mass.

If engineers were obliged to pay 6 per cent interest on all reesrves, it is safe to assume that they would soon experience a change of heart.

Practically all of the evils referred to are attributable to the blanket clauses contained in our contracts.

In conclusion, I would suggest that when engineers, as a body, concede that the business of contracting is a legitimate and honorable profession, requiring a marked degree of ability, knowledge and experience; when they are ready to co-operate with and not antagonize the contractor who is trying to fulfill the requirements under trying conditions; when they recognize the fact that they have no right to expect something for nothing, and when they are willing to deal with the contractor in the same spirit of fairness and charity that they would with their grocer or other dealer at home, then, and not until then, can we expect perfect harmony and mutual understanding.

Mr. Edward S. Larned: It is not so much the specific terms of the specification as it is who is going to interpret the same, and in my experience it has come to be largely a matter of personal equation, and if this was more generally impressed upon the minds of engineers and their clients they would see the full significance of it. I haven't a doubt that on some work the cost is enhanced from 10 to 15 per cent by reason of the fact that certain engineers are going to direct it. Contractors know by previous experience that they must allow at least that much margin to cover the exacting requirements of the engineer directing the work. It is not that such engineer directs the work. It is not that such engineers get, perhaps, a better quality of work, but it is because they are, in the minds of contractors, unreasonable in their requirements.

Another feature of engineering control which is of very great importance to the contractor is that of the function of the directing engineer or the inspector. Now on some work it has been found that inspectors who were intrusted with the passing upon the quality of materials and workmanship do not stop with that, but in their zeal and interest they go further. They attempt to direct the work. In other words, if the contractor is a man who is disposed to resist the dictation of that sort of an inspector, he may, under some conditions, claim that it is interference, and under the strict interpretation of the meaning of the act, the inspector is interfering. And in just so far as he does that he is doing the contractor a very great injustice. The contractor, on the other hand, realizes that it is policy for him to be reasonable, amiable and willing, and he oftentimes does things that he knows are causing him a very serious loss in the performance of the work, but he does it as a matter of policy. Things are very much better now than in times past Chief engineers have come to appreciate that they must look after their engineering assistants a little bit more closely, and that is a feature I would like to call attention to. Oftentimes contractors are not so much afraid of the interpretation of the engineer who draws the specification, or the man who is really in charge of the work, as they are of the assistant who is put in control of the work. Oftentimes the chief engineer is far removed from the source of the trouble. He may be fifty miles or even much further away, and it takes a long time to bring in a question of arbitration. A contractor is reluctant to resort to that. He knows it is policy for him to conform in every way to the desires of the assistant in charge of the work, and naturally refrains from reporting to the chief engineer that he thinks things are being done that to him are an injustice. This is a very important feature. And in connection with that I have often seen the importance of having a more intimate association between the chief and his engineering assistants. It would be a very helpful thing if chief engineers could bring their assistants together at stated intervals and have an exchange of ideas, a sort of question-box proposition, and let the young engineers or inspectors, who are the men directly in charge of the work, bring up questions of doubt or in dispute so the chief may discuss and explain the same, and in this way educate and broaden the men intrusted with the carrying out of his ideas. In the advertisement, and in the contract itself, the engineer distinctly reserves to himself the right to award the contract to the contractor who will best serve the interests of the other party. If a contractor is notoriously dishonest or untrustworthy, even though he be able to furnish bonds, there is no reason why the engineer should award him that contract. He would simply be inviting trouble. He should exclude that man's bid. Why does any reputable contractor make a reputation for himself? That is his capital, and if by so doing he can get contracts at a better price, he is entitled to them. There is no profit to an engineer or a corporation or an individual in having disreputable contractors do work.

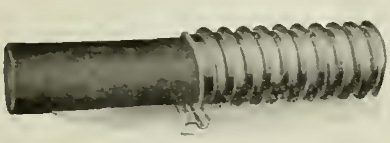
When contractors willfully speculate in their bid prices and then depend on their ability to deceive the engineer or his nonenforcement of the specification, they deserve all the trouble, expense and loss they sometimes suffer. Mutual confidence, well justified, spells success to both engineer and contractor as a rule; if the engineer be narrow, mean and impolitic, he will find some contractors able and ready to go him one better, and it is well for this engineer to remember that it is a case of one man or at best a few men against an organization.

Mr. G. T. Sampson: It appears to me, gentlemen, that the remarks of the contractors in this case have been offered as criticisms of the existing state of affairs, without suggesting any remedy. Certainly the blanket conditions of the specifications are drawn very arbitrarily, but it is necessary that the engineer in charge of the work should be upheld in his position and he should be recognized as the ruling authority in order that the work may be properly executed. His duty is in the nature of that of a military officer. He stands in the attitude of a military officer, and further than that, he stands as an agent or steward of the owner—the man who provides the money to pay for the work to be done. The whole subject rests upon the fundamental idea of money and profit, as the contract and specifications are prepared to define just what work is to be performed and material furnished for a given amount of money. A contractor goes to the bank, writes his note perhaps in the ordinary course of business, and he knows very well that he has got to pay the interest on that note. He knows that the banker is going to hold him right up to the full terms and conditions of that note, and that money put out at interest throughout the entire world demands just such returns and just such complete fulfillment. He takes such things as a matter of course and not to be changed. The contract for material and workmanship when signed is something of the same nature. Why should its conditions be considered less binding than the obligation of the banker's note? When the contract and specifications are executed the engineer is just as much bound by these conditions as the contractor himself, in that he stands as the agent and steward of the owner to see that the work is properly executed and the conditions fulfilled. These blanket conditions and general terms of the contract stand, we may say, somewhat in the light of the blue laws on the statute books—conditions and precedents brought down from years away back. It may be that they are proper; it may be that they are unnecessary. Their need cannot be foretold before the prosecution of the work except on general principles. They are there as police regulations—in case of need to uphold the authority of the engineer. They have all been brought into this form which is in use to-day by exigencies in the past in which they have been found to be necessary. They are proved. They are the accumulation of the wisdom of many different men. It is a legal protection, and the law is determined in its judgments largely by precedent. I think engineers as a rule are held by the community at large and by all those who are acquainted with them to be men who are fair and just and honest, as much so, perhaps, as any other branch or set of professional men. Their training, their study, the solution of the problems which come to them, teach them to be honest. They know they won't get good results unless they adhere to the calculations on which their work is based. The engineer who designs a piece of work, if experienced and competent, knows best what is intended to be done; he knows the features of greatest importance; he knows those which are of lesser importance. Then let not the contractor, after accepting work under a specification, assume to vary from its conditions except by consent of the engineer and his employer. Man, however, is not infallible by any means, whether he is an engineer or a contractor. Some errors are sure to show up, and a properly worded contract should have a provision as a fair remedy for the same. It is a rule in business which can safely be adopted, I think, that the man who holds the purse strings is bound to get the worth of his money when he spends it, if he can. The contractor who quarrels with the engineer who is fair and honest and reasonable is putting himself in a wrong position.

(To be concluded.)

Flexible Steel Armored Hose for Steam Service.

Every user of steam hose, especially in connection with steam drills, knows to what hard service the hose is subjected. The quality of the hose has been improved and various coverings have been tried on it, yet the life of the best hose is comparatively short. Beside the heat and pressure on the inside, the outside of the hose is dragged through water and over sharp rocks and tools and other heavy articles are dropped on it. It is little wonder that hose is used up quickly. To protect the hose from this rough usage and lengthen its life, the flexible-armored hose has been perfected.



The small cut shows its construction. The steam hose is completely incased in a steel armor. This armor fits so snugly to the hose that the hose merely acts as a packing, all the stress being taken care of by the steel. It is stated that a 1-in. 3-ply hose has withstood a hydraulic pressure of 2,000 lbs. If the hose breaks the armor still holds it together, so the hose can continue to be used until an opportunity arises for it to be repaired. The hose is perfectly flexible and can be readily handled by the drillmen. It is adapted for either steam or air.

The flexible armored hose is manufactured by the Sprague Electric Co., 527 W. 34th St., New York, who issue a bulletin descriptive of the hose and its uses.

The Cost of Erecting a Blacksmith Shop, Barn and Telegraph Office.

We give in this issue the detailed cost of erecting a blacksmith shop, a telegraph office and a barn for railroad purposes. The work was done by day labor. A summary of costs is given to allow of a comparison with other cheap structures, the cost of which we have given in this series of articles.* It will be noticed that the price of lumber is very low.

Blacksmith shop, 20x30 ft.; area 600 sq. ft.

Weight:	Pounds.
2,120 ft. B. M. at 3,300 lbs.	6,996
4½ M shingles at 150	675
Hardware	35
Total, 4 tons	7,706
Lumber:	
320 ft. B. M. at $8.00	$2.56
1,800 ft. B. M. second hand at $4	7.20
2,120 ft. B. M., total at $4.60 (av.)	$9.76
4½ M. shingles, at $1.65	7.43
Hardware:	
20 lbs. 8d nails, at $2.10	$0.42
5 lbs. 20d nails, at $2.00	.10
10 lbs 3d nails, at $2.45	.25
Total	$0.77
Labor:	
Superintendence	$ 4.80
Carpenter, 10.4 days, at $2.10	21.82
Total	$26.62

SUMMARY.

	Totals.	Per Cent
Materials:		
2,120 ft. B. M. at $4.60	$ 9.76	21.4
4½ M. shingles, at $1.65	7.43	16.7
Hardware	.77	1.9
Total materials	$17.96	40.0
Labor	$26.62	6.00
Grand total materials and labor	$44.58	100.0

	Cost sq. ft.	Per Cent.
Materials	$0.030	40.0
Labor	0.044	60.0
Total	$0.074	100.0

The low cost of materials for this building is explained by the fact that six-sevenths of it was second-hand material. The building had no floor, and no studs were used in the sides. The cost per M. ft. B. M. for the labor on the lumber was $12.55.

Hay barn, 20x35 ft.; area 700 sq. ft.

Weight:	Pounds.
6,794 ft. B. M., 3,300 lbs.	22,420
7 M. shingles, 150	1,050
Hardware, paint, etc	475
Total, 12 tons	23,945
Lumber:	
2,585 ft. B. M., at $7.50	$19.39
1,613 ft. B. M., at $8.00	12.90
496 ft. B. M., at $12.00	5.95
2,000 ft. B. M., at $8.00	16.00
100 ft. B. M., at $17.00	1.70
6,794 ft. B. M., total at $8.23 (av.)	$55.94
7 M. shingles, at $1.35	$9.45
Millwork:	
2 window sash, at $0.75	1.50
Hardware:	
200 lbs. 20d nails, at $3.55	7.10
200 lbs. 10d nails, at $3.55	7.10
20 lbs. 3d nails, at $3.95	.79
3 lbs. 8d nails	.15
3 lbs. 3d nails	.12
2 pair 10-in. strap hinges	.32
36 1½-in. screws	.07
1 8-in. hasp	.07
2 8-in. bar locks	.34
No. 10 screws	.01
Total	$16.07
Paint:	
5 gals. outside body paint, at $0.75	$3.75
2½ gals. oil, at $0.58	1.45
Total	$5.20
Labor:	
Engineering	$ .80
Building hay barn:	
Foreman, 4 days, at $85 per month	$10.95
Carpenter, 20 days, at $2.50	50.00
Carpenter, 6 days, at $2.25	13.50
Helpers, 5 days, at $1.75	7.00
Total	$81.45
Moving material from barn, helper, 1 day, at $1.75	$ 1.75
Cutting door in back and placing it, carpenter, 1 day, at $2.50	2.50
Painting barn:	
Carpenter, 1 day, at $2.50	$ 2.50
Bridgeman, 2 days, at $2.25	4.50
Total	$ 7.00
Total labor	$93.50
Tools	$ 4.98

SUMMARY.

	Totals.	Per Cent.
Materials:		
6,794 ft. B. M., at $8.23	$55.94	30.0
7 M. shingles, at $1.35	9.45	5.1
Millwork	1.50	0.8
Hardware	16.07	8.6
Paint	5.20	2.7
Total materials	$88.16	47.2
Labor:		
Engineering	$ .80	0.5
Building	81.45	43.6
Moving lumber, etc	1.75	0.9
Cutting door in back	2.50	1.3
Painting	7.00	3.7
Total labor	$ 93.50	50.0
Total materials and labor	181.66	97.2
Tools	4.98	2.8
Grand total	$186.64	100.0

	Cost sq. ft.	Per Cent.
Materials	$0.126	47.2
Labor	0.133	50.0
Tools	0.007	2.8
Total	$0.266	100.0

The cost of labor per M. ft. B. M. of lumber used was $13.76.

Telegraph office, 12x12 ft.; area 144 sq. ft.

Weight:	Pounds.
2,332 ft. B. M., at 3,300 lbs.	7,695
2 M. shingles, at 150 lbs.	300
Hardware, etc	150
Total, 4 tons	8,145
Lumber:	
185 ft. B. M., at $12.00	$ 2.22
230 ft. B. M., at $15.00	3.45
340 ft. B. M., at $16.50	5.61
431 ft. B. M., at $15.00	6.47
243 ft. B. M., at $12.00	2.91
73 ft. B. M., at $26.00	2.03
200 ft. B. M., at $20.00	4.00
630 ft. B. M., at $30.00	18.90
2,332 ft. B. M. total, at $19.55 (av.)	$45.59
2 M. shingles, at $3.50	$7.00
Mill work:	
3 window sashes	3.28
Hardware:	
75 lbs. tar paper	$1.52
1 pair strap hinges	.20

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*See Engineering-Contracting Aug. 28, Sept. 11, Oct. 9, and Oct. 30.

Screws	.04
1 rim hook	.30
6 lbs. 6d nails	.18
5 lbs 8d nails (finishing)	.31
10 lbs. 4d nails	.30
30 lbs. 10d nails	.84
Total	$3.69
Labor:	
Foreman, 3 days, at $80 per month	$ 7.74
Carpenter, 11 days, at $2.50	27.50
Total	$35.24

SUMMARY.

	Totals.	Per Cent.
Materials:		
2,332 ft. B. M., at $19.55	$45.59	48.0
2 M. shingles, at $3.50	7.00	7.3
Millwork	3.28	3.5
Hardware	3.69	3.9
Total materials	$59.56	62.7
Labor	35.24	37.3
Grand total	$94.80	100.0

	Cost sq. ft.	Per Cent.
Materials	$0.413	62.7
Labor	0.245	37.3
	$0.658	100.0

The cost per M ft. B. M. of lumber used for labor on the office was $15.11. This building had a floor in it and a ceiling, hence the cost per sq. ft. of area, and the cost per M ft. of lumber used would be higher than in the other two buildings.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write direct to the advertisers and state that you saw the catalog mentioned in *Engineering-Contracting*. If you are in the market for tools, machinery or supplies tell us and we will notify promptly the leading manufacturers.

No. 0434. **Material Hoists.** Wallace-Lindesmith Hoist Co., Los Angeles, Cal.

A compact portable hoist for hoisting concrete, lumber, etc., to the various stories of building work is described and illustrated in this pamphlet. A skip or carriage runs on two vertical guides or tracks of T-bars, being operated by wire cable from engine on the ground to head sheaves. The skip for concrete work is arranged to dump automatically at any point along the tracks. Drawings and descriptive text explain clearly the construction, method of erection and method of operation of the hoist. There are also records of work done. The device is one that building contractors will do well to investigate. The company also makes hoisting engines, gas engine and electric motor hoists and concrete carts.

No. 0435. **Mechanical Filters.** The New York Continental Jewell Filtration Co., New York and Chicago.

This company manufactures filters and installs filtration plants of the New York, Continental, Jewell, Hyatt, Warren, American, National and Blessing types and this pamphlet gives illustrations and descriptions of construction, tables of sizes, capacities, weights, etc., and records of chemical and bacteriological tests.

No. 0436. **Electric Devices and Machinery for Naval Use.** The Cutler-Hammer Mfg. Co., Milwaukee, Wis.

This pamphlet should prove useful to anyone who sells electric motors or motor driven machinery for naval use. The company named has made a special study of Navy Department requirements and in the booklet just issued full descriptions, illustrations, dimension diagrams and shipping weights are given on starting panels, speed regulating panels, machine tool controllers, resistances, circuit breaker panels, etc. In the preface attention is called to the fact that navy specifications preclude in nearly all instances the use of ordinary controlling panels and, furthermore, that apparatus acceptable for use in navy yards will not always be acceptable if supplied for use on shipboard. How to select the proper piece of apparatus in each case is fully explained, and in addition to numerous illustrations of electric controlling appliances conforming to Bureau of Construction and Repair and Bureau of Equipment specifications, the booklet includes several views of battleships equipped with Cutler-Hammer Control.

No. 0437. **Lifting Magnets.** Cutler-Hammer Clutch Co., Milwaukee, Wis.

In addition to the fact that it gives a really good idea of the construction, operation and use of lifting magnets this pamphlet is an excellent example of trade pamphlet work. The pamphlet contains a number of full page illustrations showing lifting magnets handling pig iron, steel stampings, castings, scrap and other material, together with diagrams, data on current consumption, and information on lifting capacity of magnets. A new cable take-up device is also pictured and described and reference is made to the Cutler-Hammer system of control by which the strong inductive reaction, or "kick" which occurs when the circuit is suddenly opened on a magnet coil, is automatically shunted to a discharge resistance, thus protecting voltage outside of the coil itself.

No. 0438. **Quick Unloading Car Chutes.** Quick Unloading Car Chute Co., Birmingham, Ala.

The device described and illustrated in this pamphlet should be investigated by contractors having to unload bulk material like broken stone, gravel, sand, coal and slag from cars into wagons. It consists of a chute which can be hung by brackets to the side of the car and which is loaded by shovelers between trips of the wagon. Two chutes are generally used, one at each end of the car, and together they give a wagon-load. By pulling a lever the driver dumps each chuteful into the wagon, thus taking only about a minute to load his team and get away. The chute is adjustable to any car and its construction and operation are fully described in the pamphlet.

No. 0439. **Wrought Iron and Wire Mesh Fences.** Anchor Post Iron Works, New York, N. Y.

This is a neatly printed and illustrated pamphlet discussing the design and use of wrought iron and wire mesh fences for estates, cemeteries, poultry and game enclosures, paddocks, etc. Many of the structures shown are from work done after the designs of prominent architects and artists and show excellently the artistic work that can be done in the way of metal fencing.

No. 0440. **Calculating Machines.** W. A. Morschhauser, 1 Madison Ave., New York, N. Y.

The calculating machine illustrated and described in this pamphlet is designed for working out any calculation that can be made by addition, subtraction, multiplication and division. It is stated to be the only calculating machine that requires but one turn of the crank for such figures in the multiplier or quotient. The machine is illustrated and described and brief directions are given for various operations to demonstrate its simplicity.

No. 0441. **Box Electric Drills.** Box Electric Drill Co., New York, N. Y.

This bulletin shows sectional drawings of box electric drills and describes their construction and operation. An interesting comparison of efficiency is made with compressed air drills.

No. 0442. **Kennon's Teredo-Proof Paint.** The Teredo-Proof Paint Co., New York, N. Y.

This pamphlet gives records of experiences and of tests, with argument, to prove that the special paint named is an absolute protection for wood against marine borers, white ants and other wood destroying insects and also a protection against rapid decay. The text is well written and the pamphlet may be read with advantage by anyone having wooden structures to guard against teredo.

No. 0443. **Hoisting Engines.** Monighans Machine Works, Chicago, Ill.

This firm manufactures a full line of hoisting engines for mining, quarrying, pile driving, bridge erection, building and general contracting work and also special hoisting stunts for any purpose. This pamphlet illustrates and briefly describes each pattern of engine with tables of dimensions, weights, etc.

No. 0444. **Gas and Oil Engines.** Flinchbaugh Mfg. Co., York, Pa.

The engines illustrated and described in this pamphlet are designed to use either gas, gasoline, kerosene or alcohol and are confidently claimed to operate well with either of these fuels. Of the several machines made, the special hoisting engines and the traction engines are of particular interest to contractors. Both machines are adequately described and should be investigated by our readers.

No. 0445. **Concrete Brick.** The Composite Brick & Roofing Tile Co., Baltimore, Md.

The concrete brick described in this circular is shaped like a block letter U; the two uprights being 8 ins. long and 2 ins. thick and the bottom of the U being the thickness of the wall. The bricks are laid in the wall with the arms extending to the right in one course and to the left in the next course so that a clear hollow wall is had from top to bottom and end to end. The circular describes the composition of and the method of molding the brick and illustrates their use in wall construction.

Personals.

Mr. Glen D. Holmes has been appointed Chief Engineer in charge of the projected intercepting sewer work in Syracuse, N. Y.

Mr. O. F. Purnell has been made District Manager of the office recently opened at Deadwood, S. Dak., by Allis-Chalmers Co., Milwaukee, Wis.

Mr. Edward DeForest Candee, of 495 Eighth Ave., Brooklyn, N. Y., has been appointed Assistant Commissioner of Public Works for the Borough of Brooklyn.

Mr. E. F. Robinson, Assistant Engineer of Track of the Buffalo, Rochester & Pittsburg Ry., has been appointed acting Chief Engineer to succeeed Mr. J. M. Floesch, resigned.

Mr. William C. Shaw, Jr., has been appointed Chief Engineer of the Georgia, Southern & Florida Ry., with headquarters at Macon, Ga. He succeeds Mr. G. B. Herrington, resigned.

Mr. Oscar F. Lackey, Harbor Engineer and President of the Harbor Board of Baltimore, Md., sailed from that city Nov. 2, for Europe, where he will make a study of European dock systems.

Mr. Jacob G. Rubenstein, heretofore computer in the Bureau of Public Works, Queens Borough, has been transferred to a similar position with the Board of Aqueduct Commissioners, New York City.

Mr. B. M. Hall, M. Am. Soc. C. E., N. Am. Inst. M. E., of Atlanta, Ga., left that city Nov. 4, for Mexico where he will be during the month of November, making mine examinations in the State of Oaxaca.

Mr. H. Russell, heretofore Supervisor of the Maryland Division of the Pennsylvania R. R., has been appointed Assistant Engineer of the Allegheny Division at Pittsburg, Pa., to succeed Mr. J. R. McGraw, furloughed.

Mr. Robert Lindenthal for the past few years Manager of Arthur Koppel Co., at 66 Broad St., New York, has resigned his position with that concern and will go to Berlin, Germany, where he will open offices as a representative of American manufacturers.

Dr. Samuel Fortier, Irrigation Engineer at Berkeley, Cal., in the office of Experiment Stations, U. S. Department of Agriculture, has been promoted to the position of Chief of Irrigation Investigation and Mr. C. G. Elliott, heretofore Chief Drainage Engineer, office of Experiment Stations, U. S. Department of Agriculture, has been made Chief of Drainage Investigations.

Mr. Henry B. Seaman, for some time past Consulting Engineer to the Bridge Department of New York City, has been appointed Chief Engineer for the Public Service Commission of the New York State for the counties of New York, Kings, Queens and Richmond. He succeeds Mr. George S. Rice who will remain in the service of the Commission as Assistant Engineer in charge of construction. Mr. Seaman entered the Engineering Department of the Erie R. R., soon after his graduation from Swathmore College. He was with this road three years, leaving to take a position on Kings County Elevated line in Brooklyn, N. Y. He then became connected with the Bridge Department of the Pennsylvania R. R., and later was engaged for three years as Principal Assistant Engineer with Wilson Bros., of Philadelphia. He then returned to the Erie R. R. and for two years was Bridge Engineer, leaving to go with the New York, New Haven & Hartford R. R. Subsequently he was in charge of the engineering work for the sub-contractor for the 4th ave. section of the New York Subway.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED.

Bridges.

Nov. 6.	Muncie, Ind.	Oct. 23
Nov. 6.	Paoli, Ind.	Oct. 30
Nov. 6.	Thief River Falls, Minn.	Nov. 6
Nov. 7.	Mauch Chunk, Pa	Oct. 30
Nov. 8.	Washington, Pa.	Oct. 23
Nov. 8.	Cincinnati, O.	Oct. 23
Nov. 8.	Redding, Cal.	Oct. 23
Nov. 8.	Carman, Man.	Oct. 30
Nov. 8.	Cincinnati, O.	Nov. 6
Nov. 9.	Richmond, Ind.	Oct. 23
Nov. 9.	Richmond, Va.	Nov. 6
Nov. 9.	Des Moines, Ia	Nov. 6
Nov. 10.	Erie, Kan.	Oct. 30
Nov. 15.	Glendive, Mont.	Oct. 2
Nov. 11.	Wharton, Tex.	Oct. 30
Nov. 12.	Troy, O.	Oct. 16
Nov. 12.	Hamilton, O.	Oct. 30
Nov. 15.	Portland, Ore.	Oct. 23
Nov. 15.	Cincinnati, O.	Oct. 30
Nov. 15.	Cincinnati, O	Nov. 6
Nov. 20.	Georgetown, S. C.	Oct. 30
Nov. 29.	Portland, Ore.	Nov. 6
Nov. 29.	Bethlehem, Pa.	Nov. 6
Feb. 13.	St. Charles, Mo	Oct. 30

Buildings.

Nov. 6.	Luverne, Ala.	Oct. 16
Nov. 6.	Polk, Pa.	Oct. 30
Nov. 6.	McKeesport, Pa.	Oct. 30
Nov. 6.	Chicago, Ill.	Oct. 30
Nov. 6.	Lafayette, Ind.	Oct. 30
Nov. 6.	Chicago, Ill.	Oct. 30
Nov. 7.	National Soldiers Home, Va.,	Oct. 23
Nov. 7.	Fulton, N. Y.	Oct. 23
Nov. 8.	Fort Stevens, Ore.	Oct. 23
Nov. 8.	Harrisburg, Pa.	Nov. 6
Nov. 9.	Las Animas, Colo.	Sept. 25
Nov. 9.	Albany, N. Y.	Nov. 6
Nov. 11.	Pensacola, Fla.	Oct. 16
Nov. 11.	Cincinnati, O.	Oct. 23
Nov. 11.	Des Moines, Ia	Oct. 23
Nov. 11.	Fort Rosecrans, Cal	Oct. 30
Nov. 11.	Atlantic City, N. J	Oct. 30
Nov. 12.	Pipestone, Minn.	Oct. 16
Nov. 11.	New Orleans, La	Oct. 16
Nov. 11.	Salem, Ind.	Nov. 6
Nov. 11.	Brooklyn, N. Y	Nov. 6
Nov. 11.	Harrisburg, Pa.	Nov. 6
Nov. 12.	Seattle, Wash.	Oct. 16
Nov. 12.	Harrisburg, Pa.	Nov. 6
Nov. 13.	Central Islip, N. Y	Nov. 6
Nov. 14.	Pine Grove, Pa	Oct. 30
Nov. 14.	Jersey City, N. J	Nov. 6
Nov. 14.	Jersey City, N. J	Nov. 6
Nov. 14.	Denver, Colo.	Nov. 6
Nov. 15.	Chippewa Falls, Wis	Oct. 9
Nov. 15.	Fort D. A. Russell, Wyo	Oct. 30
Nov. 15.	Superior, Wis.	Oct. 30
Nov. 15.	South Bend, Ind	Nov. 6
Nov 19.	Jefferson Barracks, Mo	Oct. 30
Nov. 20.	Fort Monroe, Va	Oct. 30
Nov. 21.	New Orleans, La	Oct. 9
Nov. 21.	Greenville, Tenn.	Oct. 23
Nov. 22.	Portsmouth, Va.	Oct. 23
Nov. 25.	Tyler, Tex.	Oct. 23
Nov. 27.	Fort Mackenzie, Wyo	Nov. 6
Nov. 27.	Washington, D. C.	Nov. 6
Nov. 29.	Marion, Ind.	Oct. 30
Nov. 29.	New Alhany, Ind	Nov. 6
Dec. 2.	Devils Lake, N. Dak	Nov. 6
Dec. 3.	Nevada, Mo.	Oct. 30
Dec. 5.	Waldoboro, Me.	Oct. 30
Dec. 9.	Wernersville, Pa.	Nov. 6
Dec. 17.	Detroit, Mich.	Nov. 6
Dec. 23.	Ann Arbor, Mich	Nov. 6

Roads and Streets.

Nov. 6.	Spokane, Wash.	Oct. 23
Nov. 6.	Brooklyn, N. Y	Oct. 30
Nov. 6.	York, Pa.	Oct. 30
Nov. 6.	Kokomo, Ind.	Oct. 30
Nov. 7.	Rockville, Ind.	Oct. 16
Nov. 7.	New York, N. Y	Oct. 30
Nov. 7.	Kansas City, Mo	Oct. 30
Nov. 7.	Chicago, Ill.	Oct. 30
Nov. 7.	West Seneca, N. Y	Oct. 30
Nov. 7.	Fort Wayne, Ind	Oct. 30
Nov. 7.	Memphis, Tenn.	Nov. 6
Nov. 7.	Youngstown, O.	Nov. 6
Nov. 9.	Janesville, Wis.	Oct. 23
Nov. 9.	Hobart, Okla.	Oct. 30
Nov. 9.	Olympia, Wash.	Nov. 6
Nov. 11.	New York, N. Y	Oct. 30
Nov. 11.	Indianapolis, Ind.	Oct. 30
Nov. 11.	Camden, N. J	Nov. 6
Nov. 11.	Atlantic, City, N. J	Nov. 6
Nov. 11.	Kansas City, Mo	Nov. 6
Nov. 11.	Indianapolis, Ind.	Nov. 6
Nov. 12.	Troy, O.	Oct. 16
Nov. 12.	Denton, Md.	Oct. 30
Nov. 12.	Harrisburg, Pa.	Oct. 23
Nov. 12.	Lima, O.	Nov. 6
Nov. 12.	Chicago, Ill.	Nov. 6
Nov. 13.	Brooklyn, N. Y	Nov. 6
Nov. 14.	New York, N. Y	Nov. 6
Nov. 15.	Pensacola, Fla.	Oct. 23
Nov. 15.	Pittsburg, Pa.	Nov. 6
Nov. 15.	Cincinnati, O.	Nov. 6
Nov. 15.	Chillicothe, Mo.	Nov. 6
Nov. 16.	Bluffton, Ind.	Nov. 6
Nov. 18.	Albany, N. Y	Oct. 30
Nov. 18.	Atlanta, Ga.	Nov. 6
Nov. 19.	Swatara, Pa.	Nov. 6
Nov. 19.	Harrisburg, Pa.	Nov. 6
Nov. 20.	Harrisburg, Pa.	Nov. 6
Nov. 20.	Des Moines, Ia	Nov. 6
Nov. 20.	Hot Springs, Ark	Nov. 6
Nov. 21.	Albany, N. Y	Oct. 30
Nov. 21.	Harrisburg, Pa.	Nov. 6
Nov. 22.	Harrisburg, Pa.	Nov. 6
Nov. 25.	Columbia, S. C	Oct. 30
Nov. 26.	Fort Flagler, Wash	Nov. 6
Nov. 29.	Logansport, Ind.	Nov. 6
Dec. 3.	Monticello, Ind.	Nov. 6
Dec. 6.	Salt Lake City, Utah	Oct. 23
Dec. 13.	Monticello, Ind.	Oct. 30

Sewers.

Nov. 6.	Brooklyn, N. Y	Oct. 30
Nov. 6.	Chicago, Ill.	Oct. 30
Nov. 6.	Akron, O.	Oct. 30
Nov. 7.	White Plains, N. Y	Oct. 23
Nov. 7.	West Seneca, N. Y	Oct. 30
Nov. 7.	McKeesport, Pa.	Oct. 30
Nov. 7.	St. Paul, Minn	Oct. 30
Nov. 7.	Hattiesburg, Miss.	Oct. 30
Nov. 7.	Fort Wayne, Ind	Oct. 30
Nov. 7.	Galveston, Tex.	Nov. 6
Nov. 7.	Youngstown, O.	Nov. 6
Nov. 8.	Decatur, Ill.	Nov. 6
Nov. 9.	Hobart, Okla.	Oct. 30
Nov. 9.	Chagrin Falls, O	Oct. 30
Nov. 11.	Seymour, Ind.	Oct. 30
Nov. 11.	North Milwaukee, Wis	Oct. 30
Nov. 11.	New York, N. Y	Oct. 30
Nov. 11.	Indianapolis, Ind.	Oct. 30
Nov. 11.	Indianapolis, Ind.	Nov. 6
Nov. 11.	Lancaster, Pa.	Nov. 6
Nov. 11.	Wahpeton, N. Dak	Nov. 6
Nov. 13.	Reading, Pa.	Oct. 30
Nov. 14.	St. Paul, Minn	Nov. 6
Nov. 15.	Boston, Mass.	Oct. 30
Nov. 20.	Springfield, O.	Nov. 6
Nov. 20.	Des Moines, Ia	Nov. 6
Nov. 20.	Oakland, Cal.	Nov. 6
Dec. 2.	Cadillac, Mich.	Oct. 23
Dec. 3.	Auburn, N. Y	Oct. 16
Dec. 6.	Salt Lake City, Utah	Nov. 6

Water Supply.

———	Alexandria, Va.	Nov. 6
Nov. 7.	Chilocco, Okla.	Oct. 16
Nov. 8.	Howell, Mich.	Nov. 6
Nov. 9.	Hobart, Okla.	Oct. 30
Nov. 11.	Fort Terry, N. Y	Oct. 23
Nov. 12.	Pipestone, Minn.	Oct. 16
Nov. 12.	Velva, N. Dak	Oct. 30
Nov. 14.	Fort Mackenzie, Wyo	Oct. 23
Nov. 14.	Grand Forks, N. Dak	Nov. 6
Nov. 15.	Phoenix, Ariz.	Oct. 2
Nov. 18.	Saint Clairsville, O.	Nov. 6
Nov. 21.	Santa Fe, N. Mex	Nov. 6
Nov. 28.	Fort Morgan, Ala	Nov. 6
Dec. 1.	Phoenix, Ariz.	Oct. 16
Dec. 17.	Camden, N. J	Oct. 16

Miscellaneous.

Nov. 6.	Rye, N. Y.,	Dock,	Oct. 30
Nov. 6.	McKeesport, Pa.,	Iron Fence,	Oct. 30
Nov. 7.	Fort Des Moines, Ia.,	Fence, Etc.,	Oct. 23
Nov. 7.	New York, N. Y.,	Pontoon,	Nov. 6
Nov. 7.	Pittsburg, Pa.,	Electric Light Plant,	Nov. 6
Nov. 8.	Kokomo, Ind.,	Electric Lighting,	Oct. 9
Nov. 8.	Kokomo, Ind.,	Electric Plant,	Oct. 16
Nov. 8.	Minneapolis, Minn.,	Street Lighting,	Nov. 6
Nov. 11.	New York, N. Y.,	Towers,	Oct. 30
Nov. 11.	New York, N. Y.,	Grand Stand,	Nov. 6
Nov. 12.	Chicago, Ill.,	Dock, Dredging,	Nov. 6
Nov. 13.	Chicago, Ill.,	Chimney,	Nov. 6
Nov. 13.	New York, N. Y.,	Fire Protection System,	Nov. 6
Nov. 14.	New Orleans, La.,	Monument,	Oct. 16
Nov. 14.	Jersey City, N. J.,	Fences, Etc.,	Nov. 6
Nov. 14.	New York, N. Y.,	Steamboats,	Nov. 6
Nov. 15.	Charleston, S. C.,	Street Lighting,	Sept. 11
Nov. 16.	Charleston, S. C.,	Concrete Pier,	Oct. 23
Nov. 18.	Dallas, Tex.,	Lock and Dam,	Oct. 16
Nov. 18.	Erie, Pa.,	Street Lighting,	Nov. 6
Nov. 20.	New Orleans, La.,	Dredge,	Oct. 2
Nov. 20.	Ludington, Mich.,	Breakwater,	Oct. 30
Nov. 21.	Galveston, Tex.,	Jetty Work,	Oct. 30
Nov. 21.	Austin, Tex.,	Concrete Wall,	Oct. 30
Nov. 21.	Fort Sumter, S. C.,	Wharf,	Oct. 30
Nov. 25.	Mobile, Ala.,	Locks and Dams,	Oct. 2
Dec. 4.	Altoona, Pa.,	Garbage Disposal,	Nov. 6

Excavation, Earth and Rock.

———	Kensett, Ark.,	Railroad Grading,	Nov. 6
Nov. 6.	Brooklyn, N. Y.,	Dredging,	Oct. 30
Nov. 6.	Brooklyn, N. Y.,	Grading Lot,	Oct. 30
Nov. 6.	Emmetsburg, Ia.	Tile Drain,	Oct. 30
Nov. 7.	New Boston, Ill.,	Ditch and Levee Work,	Oct. 16
Nov. 10.	Lawton, Okla.,	Railroad Grading,	Nov. 6
Nov. 11.	Prophetstown, Ill.,	Ditch Work,	Oct. 23
Nov. 12.	Pine Bluff, Ark.,	Levee Work,	Oct. 30
Nov. 12.	West Point, Miss.,	Canal,	Oct. 30
Nov. 12.	Lawrenceberg, Ind.,	Embankment,	Nov. 6
Nov. 15.	Philadelphia, Pa.,	Dredging,	Oct. 23
Nov. 16.	Pine Bluff, Ark.,	Levee Work,	Oct. 23
Nov. 19.	Fort Dodge, Ia.,	Drainage,	Oct. 30
Nov. 20.	Detroit, Mich.,	Dredging,	Oct. 16
Nov. 20.	Grand Rapids, Mich.,	Dredging,	Oct. 30
Nov. 21.	Galveston, Tex.,	Dredging,	Oct. 30
Nov. 21.	Mobile, Ala.,	Dredging,	Oct. 30
Nov. 22.	Newport, R. I.,	Dredging,	Oct. 30
Nov. 25.	Memphis, Tenn.,	Levee and Ditch,	Oct. 30
Nov. 25.	New York, N. Y.,	Dredging,	Oct. 30
Dec. 3.	Wausau, Wis.,	Drainage Ditches,	Nov. 6

Materials, Machines, Supplies, Tools, Etc.

Nov. 6.	McKeesport, Pa.,	Fire Alarm System,	Oct. 30
Nov. 7.	New York, N. Y.,	Road Rollers,	Oct. 30
Nov. 8.	Washington, D. C.,	Pumps, Cement, Etc.,	Oct. 16
Nov. 11.	Fort Totten, N. Y.,	Torpedo Cases,	Oct. 30
Nov. 11.	Chicago, Ill.,	Special Castings,	Nov. 6
Nov. 11.	New York, N. Y.,	Fire Hose,	Nov. 6
Nov. 11.	Harrisburg, Pa.,	Fire Hose,	Nov. 6
Nov. 12.	Washington, D. C.,	Cars, Jacks, Tile, Etc.,	Oct. 23
Nov. 12.	Key West, Fla.,	Boiler,	Oct. 23

Nov. 12.	Kansas City, Mo.,	Vault Equipment,	Oct. 30
Nov. 12.	Washington, D. C.,	Brick,	Nov. 6
Nov. 12.	League Island, Pa.,	Diving Apparatus,	Nov. 6
Nov. 13.	New York, N. Y.,	Lanterns,	Nov. 6
Nov. 13.	Baltimore, Md.,	Boiler,	Nov. 6
Nov. 14.	Fort Morgan, Ala.,	Pumping Plant,	Oct. 23
Nov. 15.	Winnipeg, Man.,	Water Pipe,	Oct. 9
Nov. 16.	New Fort Lyon, Colo.,	Laundry Equipment,	Oct. 30
Nov. 16.	Washington, D. C.,	Laundry Equipment,	Oct. 30
Nov. 18.	Portland, Ore.,	Hoisting Engines, Etc.,	Oct. 23
Nov. 19.	Washington, D. C.,	Car Wheels, Conduit, Etc.,	Oct. 30
Nov. 23.	New Orleans, La.,	Elevator,	Nov. 6
Nov. 25.	Atlanta, Ga.,	Pump, Pipe, Engine,	Oct. 30
Nov. 27.	Washington, D. C.,	Clock System,	Nov. 6
Dec. 1.	Phoenix, Ariz.,	Water Pipe,	Oct. 16
Jan. 15.	Manila, P. I.,	Pumps and Motors,	Oct. 30

BIDS ASKED.

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Des Moines, Ia.—Until Nov. 9, by Board Public Works, for constructing reinforced concrete culvert.

Richmond, Va.—Until noon, Nov. 9, by State Highway Commissioner, Capitol Bldg., for the construction of a 50-ft. span reinforced concrete bridge, and repairs to old abutments, over North Run Creek, on Hilliard road, near Brook turnpike, about four miles from Richmond.

Thief River Falls, Minn.—Until noon, Nov. 6, by Lars Backe, City Clerk, for building an iron bridge over Red Lake River in this city.

Cincinnati, O.—Until noon, Nov. 8, by Fred Dreihs, Clerk County Commissioners, for reflooring of suspension bridge over Whitewater River, near Harrison, O.

Cincinnati, O.—Until noon, Nov. 15, by Fred Dreihs, Clerk County Commissioners, for work under Specification No. 684 For repair of bridge over Big Miami River, near New Baltimore, Crosby Township.

Portland, Ore.—Until Nov. 29, by A. L. Barbour, City Auditor, for constructing reinforced concrete bridge over Sullivan's Gulch at E. 28th St.

Bethlehem, Pa.—Until Nov. 29, by Commissioners of Northampton County, Easton, Pa., for construction of reinforced concrete bridge at this place. L. A. Francisco, Easton, Pa., is Engineer.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Denver, Colo.—Until 3 p. m., Nov. 14, by Frank M. Downer, Custodian U. S. Mint, for miscellaneous changes in that building.

Washington, D. C.—Until noon, Nov. 27, by Elliott Woods, Superintendent, U. S. Capitol Building and Grounds, Washington, for steel framing for roof of office building, U. S. Senate.

New Albany, Ind.—Until Nov. 29, by County Commissioners, for remodeling the County Jail.

South Bend, Ind.—Until Nov. 15, by Board Public Works, for erection of hose house at Michigan St. and Milton St.

Salem, Ind.—Until Nov. 11, by Trustees of Jefferson Township, for erection of new school building in District No. 1.

Ann Arbor, Mich.—Until 3 p. m., Dec. 23, by James Knox Taylor, Supervising Architect, Washington, D. C., for construction (complete) of U. S. Post Office at Ann Arbor, Mich.

Detroit, Mich.—Until 3 p. m., Dec. 17, by James Knox Taylor, Supervising Architect, Washington, for the construction complete (except lifts), of the extension to the U. S. Post Office and Court House, at Detroit, Mich.

Jersey City, N. J.—Until 9 p. m., Nov. 14, by Board of Education, Fred Ege, Secretary, for labor and materials for erection of new school building on plot adjacent to School No. 11. John T. Rowland, Jr., Supervising Architect, 15 Exchange Pl.

Jersey City, N. J.—Until 9 p. m., Nov. 14, by Board of Education, Fred Ege, Secy., for all labor and materials necessary for the erection of fire escapes on the following school houses: Nos. 1, 9, 13, 17, 18, 19, 20, 21, 22, 23, and 26. John T. Rowland, Jr., Supervising Architect, 15 Exchange Pl., Jersey City.

Brooklyn, N. Y.—Until 11 a. m., Nov. 11, by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., New York, for installing heating and ventilating apparatus of additions to and alterations in public school 140, on 60th St, west from 4th Ave., Borough of Brooklyn. Security required $5,000.

Central Islip, N. Y.—Until 3 p. m., Nov. 13, by State Commission in Lunacy, T. E. McGarr, Secy., Albany, N. Y., for Tuberculosis. Pavilion—construction, heating, plumbing and electric work—at Central Islip State Hospital, Central Islip.

Albany, N. Y.—Until Nov. 9, by Andrew S. Draper, State Commissioner of Education, for building new school house on Onondaga Indian Reservation.

Devils Lake, N. Dak.—Until 3 p. m., Dec. 2, by James Knox Taylor, Supervising Architect, Washington, D. C., for construction of foundations, etc., for U. S. Post Office and Custom House, at Devils Lake, N. Dak.

Harrisburg, Pa.—Until Nov. 8, by Building Inspector T. F. Ferree, for erection of rear portion of new building for the Allison Fire Company.

Harrisburg, Pa.—Until noon, Nov. 11, by T. F. Ferree, Inspector of Buildings, for constructing fire engine house.

Harrisburg, Pa.—Until Nov. 12, by S. B. Rambo, Superintendent Public Grounds and Buildings, for changes to electric wiring.

Wernersville, Pa.—Until noon, Dec. 9, by J. M. Shenk, Chairman of Building Committee. State Asylum for Chronic Insane of Pennsylvania, Wernersville, Pa., for the construction of two buildings, viz.: An extension of dining room with day room for women on the second floor; also for an infirmary. A. A. Ritcher, Arch., Reading, Pa., and Lebanon, Pa.

Greenville, Tenn.—Plans and specifications are on file at Chicago office of this paper for the work at the Greenville, Tenn., National Cemetery, mentioned in our issue of Oct. 23. Bids are asked until Nov. 21, by Major M. Gray Zalinski, Q. M., Washington, D. C., the work including constructing brick lodge and outbuilding, concrete walls and sidewalks, grading, etc.

Fort Mackenzie, Wyo.—Until 10 a. m., Nov. 27, by Capt. Wm. D. Davis, Constructing Q. M., for the construction of brick quartermaster storehouse, brick quartermaster stable, brick fire station, frame coal shed, steel-clad magazine, and for the installation of plumbing, heating, electric wiring and electric fixtures in buildings where specified.

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Hot Springs, Ark.—Until Nov. 20, by F. V. P. Ellsworth, City Civil Engineer, for constructing 10,000 sq. yds. of pavement with either asphalt, bitulithic or vitrified paving block, on 6 in. concrete base. Bids are also asked for 5,000 sq. yds. of paving with vitrified paving block.

Atlanta, Ga.—Until 3 p. m., Nov. 18, by R. M. Clayton, City Engineer, for repaving Broad St., with creosote blocks, about 13,000 sq. yds.

Chicago, Ill.—Until 11 a. m., Nov. 12, by Department Public Works, 225 City Hall, for building retaining walls in W. Harrison St.; also for paving with No. 2, granite blocks.

Bluffton, Ind.—Until 10:30 a. m., Nov. 16, by C. S. Brineman, County Auditor, for constructing 20 gravel roads.

Logansport, Ind.—Until noon, Nov. 29, by Geo. W. Cann, County Auditor, for construction of gravel road on county line.

Monticello, Ind.—Until 10 a. m., Dec. 3, by J. L. Ackerman, County Auditor, for construction of macadam road in Jackson Township.

Indianapolis, Ind.—Until 10 a. m., Nov. 11, by Board Public Works, the improvement of Division St., by grading and paving sidewalks with cement.

Des Moines, Ia.—Until Nov. 20, according to reports, by Board Public Works, for constructing 14,744 sq. yds. of brick pavement.

Chillicothe, Mo.—Until Nov. 15, according to reports, by this city, for grading and paving Jackson St.

Kansas City, Mo.—Until 3 p. m., Nov. 11, by Frank P. Gossard, Secretary Park Commissioners, for grading portion of boulevard along Lydia Ave.

Atlantic City, N. J.—Until 8 p. m., Nov. 11, by City Clerk, for constructing 23,500 sq. yds. of asphalt pavement, 1,040 lin. ft. of bluestone heading stones, and one drainage system, consisting of 25 lines of conduits. J. W. Hackney, City Engineer.

Camden, N. J.—Until 11 a. m., Nov. 11, by Fred W. George, Clerk County Freeholders, for furnishing about 10,000 tons of stone and resurfacing Camden, Ellisburg and Marlton Turnpike in Camden County. J. J. Albertson, County Engineer.

Brooklyn, N. Y.—Until 11 a. m., Nov. 13, by Bird S. Coler, Borough President, for five contracts for regulating and paving with asphalt pavement, largest contract calling for 3,610 sq. yds. of asphalt, for two contracts for regulating and repaving with asphalt pavement, two contracts for regulating, grading and paving with asphalt and one contract for regulating and repaving with Medina sandstone, the last contract including 2,380 sq. yds. of pavement.

New York, N. Y.—Until 3 p. m., Nov. 14, by Department of Parks, for labor and materials for building the granolithic and brick sidewalks and the granite curbing of the concourse and approach to Baird court, in the New York Zoological Park, in Bronx Park, New York. Plans may be seen and blank forms may be obtained at the office of the Department of Parks, Zbrowski Mansion, Claremont Park, Borough of The Bronx. Security required is $7,000.

Cincinnati, O.—Until noon, Nov. 15, by Fred Dreihs, Clerk County Commissioners, for work under specifications No. 600—for improvement of Hog Back Road from corporation line of Cincinnati easterly about 2,000 ft.

Lima, O.—Until noon, Nov. 12, by L. L. Crumrine, Secy. Bd. Pub. Service, for improvement of North Jefferson St. by sewering, curbing, guttering and macadamizing. Certified check for $300 required with bid.

Youngstown, O.—Until noon, Nov. 7, by W. H. McMillen, Clerk Bd. Pub. Service, for grading Silliman St., for paving Wick Ave., and for paving Summit Ave.

Harrisburg, Pa.—Until Nov. 21, by Joseph W. Hunter, State Highway Commissioner, for constructing following state roads: Cresson Borough, Cambria County, 2,582 ft. of brick and 1,681 ft. of macadam road; Cresson Township, Cambria County, 10,952 ft. of macadam and 250 ft. of brick road, East Hempfield, Lancaster County, 5,827 ft. of road, and 14,315 ft. of road; Richland Township, Clarion County, 16,500 ft. of road.

Harrisburg, Pa.—Until Nov. 22, by Joseph W. Hunter, State Highway Commissioner, for constructing 6,427 ft. of 16 ft. wide state road in Aston Township, Delaware County.

Harrisburg, Pa.—Until Nov. 20, by Joseph W. Hunter, State Highway Commissioner, for constructing the following state roads: Waterford Borough, Erie County, 8,160 ft. of road; Waterford Township, Erie County, 3,670 ft. of road; Clearfield Borough, Clearfield County, 1,882 ft. of brick road; Bensinger Township, Elk County, 5,300 ft. of road.

Harrisburg, Pa.—Until Nov. 19, by Joseph W. Hunter, State Highway Commissioner, for construction of state roads in Westmoreland County, as follows: Loyalhanna Township, 3,900 ft. of road; North Bellevernon Borough, 1,112 ft. of brick road; Rostrover Township, 1,585 ft. of road. Bids are also asked for constructing 1,523 ft. of brick road and 5,725 ft. of macadam road in Tionesta, Forest County, and 13,088 ft. of road in Logan Township, Blair county.

Pittsburg, Pa.—Until noon, Nov. 15, by F. P. Booth, County Controller, for constructing 800 ft. of road in Elizabeth Township. Geo. T. Barnsley, County Road Engineer, 26 Court House, Pittsburg.

Swatara, Pa.—Until Nov. 19, by Joseph W. Hunter, State Highway Commissioner, Harrisburg, Pa., for constructing two roads in Swatara Township, one 3,200 ft. long, the other 10,000 ft. long.

Memphis, Tenn.—Until noon, Nov. 7, by Ennis M. Douglass, City Register, for paving portion of Orleans St. with brick. Certified check for $250 required with bid.

Fort Flagler, Wash.—Until 11:30 a. m., Nov. 26, by Lieut. John C. Henderson, Q.

M., for clearing and grading a roadway, 3,575 ft. long to connect with county road, at Fort Flagler.

Olympia, Wash.—Until 10 a. m., Nov. 9, by Joseph M. Snow, Secy. State Highway Board, for grading State Aid Road No. 4, known as the East Trunk Road in King County.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Oakland, Cal.—Until 10 a. m., Nov. 20, by Walter B. Fawcett, Secy. Bd. Pub. Wks., for labor and material for extension of east side sewer from E. 11th St. to E. 8th St. Bond of $4,500 required.

Decatur, Ill.—Until Nov. 8, by Clerk Board Local Improvements, for constructing sewer in alley, estimated to cost $665.

Indianapolis, Ind.—Until 10 a. m., Nov. 11, by Board Public Works, for constructing local sewers in Bonna Ave. and Roanoke St.

Des Moines, Ia.—Until Nov. 20, by Board Public Works, for constructing 12,325 ft. of 10 in. pipe sewer in northwestern part of city. Estimated cost is $20,000 to $25,000.

St. Paul, Minn.—Until 2 p. m., Nov. 14, for construction of sewer in Baker St. R. L. Gorman, Clk. Bd. Pub. Wks.

Wahpeton, N. Dak.—Until 8 p. m., Nov. 11, by Wm. R. Purdon, City Auditor, for constructing 380 ft., 12 in. vitrified pipe sewer.

Springfield, O.—Until noon, Nov. 20, by F. A. Crothers, Clerk Board Public Works, for constructing portion of high level intercepting sewer, involving construction of 2,096 ft., 24 in., 5,554 ft., 30 in., and 2,166 ft., 33 in., vitrified pipe, plain or reinforced concrete sewer. 17,875 cu. yds. rock excavation, etc. W. H. Sieverling is City Engineer.

Youngstown, O.—Until noon, Nov. 7, by W. H. McMillan, Clerk Bd. Pub. Service, for constructing sewer in East Federal St.; also for sewer in Truesdale St., and in Rigby St.; and for grading and sewering Perry St.

Lancaster, Pa.—Until noon, Nov. 11, by C. G. Baker, Clerk, for constructing 2,200 ft. of 108 in. reinforced concrete sewer. F. H. Shaw, 503 Woolworth Bldg., is Engineer.

Galveston, Tex.—Until Nov. 7, by John D. Kelly, City Secretary, for construction of 775 ft. of 42x66-in. reinforced concrete drain, and all appurtenances and about 750 lin. ft. of 24-in. vitrified pipe drain, with appurtenances. A. T. Dickey, City Engineer.

Salt Lake City, Utah.—Until 8 p. m., Dec. 6, Louis C. Kelsey, City Engineer, for constructing pipe sewers in sewer extension No. 191.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Morgan, Ala.—Until 2 p. m., Nov. 28, by Capt. L. F. Garrard, Constructing Q. M., Fort Morgan, Mobile, Ala., for construction of a 150,000 gallon steel tank on a 75 ft. trestle.

Howell, Mich.—Until Nov. 8, by Municipal Electric Light and Water Commission, for laying 600 ft. of 4 in. water mains.

Grand Forks, N. Dak.—Until 4 p. m., Nov. 14, by W. V. O'Connor, City Auditor, for construction of a water main in Palkenham Ave.

Santa Fe, N. Mex.—Until 11 a. m., Nov. 21, by Maj. M. Gray Zalinski, Q. M., U. S. A., Washington, D. C., for repairs to water supply and improvements at Santa Fe, (N. Mex.), National Cemetery.

Saint Clairsville, O.—Until Nov. 18, by A. W. Beatty, County Auditor, for material and installing pneumatic water system in Belmont County Childrens' Home, near Barnesville.

Alexandria, Va.—Bids are being asked by Alexandria Electric Co., 502 King St., for labor and material for the extension of the water suction line into the river, at their plant at the foot of Wolfe St.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

Kensett, Ark.—Railroad Grading.—The Missouri & North Arkansas R. R. Co., W. S. Dawley, Chief Engineer, 820 Security Bldg., St. Louis, Mo., has 650,000 cu. yds. of side borrow and three miles of pile trestle to let on 28 miles of their extension between Kensett and Cotton Plant, Ark.

Lawrenceburg, Ind.—Embankment.—Until 2 p. m., Nov. 12, by Lt. Col. Wm. T. Rossell, U. S. Engrs., Cincinnati, O., for repairing and protecting Great Miami embankment at Lawrenceberg.

Lawton, Okla.—Railroad Grading.—Until Nov. 10, by Lawton, Wichita Falls & Northwestern Ry. Co., J. M. Bellamy, President, Lawton, for grading seven miles of railway. A. J. Robinson, Chief Engineer, Frederick, Okla.

Wausau, Wis.—Drainage Ditches.—Until 2 p. m., Dec. 3, by Commissioners of Dancy Drainage District, for construction of a main ditch and all of the branch ditches. Harman Engineering Co., 109 South Jefferson Ave., Peoria, Ill., are the Engineers. Official advertisement will be found elsewhere in this issue.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Chicago, Ill.—Chimney.—Until 11 a. m., Nov. 13, by Department Public Works, 325 City Hall, for 75 ft. steel extension of chimney in City Hall.

Chicago, Ill.—Dock, Dredging.—Until 11 a. m., Nov. 12, by Department Public Works, 322 City Hall, for removal of 5,500 cu. yds. of material from bed of Chicago River at south end of Oakley Ave. and construction of 75 ft. new dock.

Minneapolis, Minn.—Street Lighting.—Until 7:30 p. m., Nov. 8, by L. A. Lydiard, City Clerk, for gas and electric street lighting; furnishing gas for street lamps; and for furnishing the city with 7,000 incandescent gas street lamps.

New York, N. Y.—Grand Stand.—Until 11 a. m., Nov. 11, by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., for the general construction, etc., of a grandstand, etc., to be placed on the athletic field on Crotona Park North, opposite Prospect and Clinton Avs., Crotona Park, Borough of The Bronx. Security required is $20,000.

New York, N. Y.—Fire Protection System.—Until 2 p. m., Nov. 13, by John H. O'Brien, Commissioner Water Supply, Gas and Electricity, 13 Park Row, for furnishing, delivering and erecting a system of water curtains, with all piping, valves, manifolds, sprinkler heads, brackets, supports and all other appurtenances, complete in place and ready for operation in the high pressure pumping stations at Oliver and South Sts., and at Gansevoort and West Sts., Borough of Manhattan. Security required is $1,000.

New York, N. Y.—Steamboats.—Until 11 a. m., Nov. 14, by John V. Coggey, Commissioner of Correction, 148 E. 20th St., for labor and materials for construction and completing of a twin screw steel passenger and freight steamer. Bids are also asked for constructing steel passenger steamboat.

New York, N. Y.—Pontoon.—Until 2:30 p. m., Nov. 7, by Robert Watchorn, Commissioner of Immigration, Ellis Island, N. Y. H., for all labor and materials required for installing new pontoon for ferry bridge at U. S. Immigrant Station, Ellis Island, N. Y. H.

Jersey City, N. J.—Fences, Etc.—Until 9 p. m., Nov. 14, by Board of Education, Fred Ege, Secy., for improvement of grounds of School No. 21 and erection of fences thereon. John T. Rowland, Jr., Supervising Architect, 13 Exchange Pl.

Altoona, Pa.—Garbage Disposal.—Until Dec. 4, by S. B. Trees, Secy. Board of Health, for disposal of city garbage for a period of one, three, five or ten years.

Erie, Pa.—Street Lighting.—Until Nov. 18, by Board Public Works, for lighting city streets.

Pittsburg, Pa.—Electric Light Plant.—Until Nov. 7, by Chas. Reisfar, Jr., Secretary High School Committee, for installing electric light plant in 5th Ave. high school building.

Materials, Machines, Supplies, Tools Etc

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Brick.—Until 2 p. m., Nov. 12, by Bernard R. Green, Superintendent of Construction, Office of Building for National Museum, Library of Congress, Washington, for red bricks for this building.

Washington, D. C.—Clock System.—Until noon, Nov. 27, by Elliott Woods, Superintendent, U. S. Capitol Building and Grounds, Washington, for an electric clock system for the office building, House of Representatives, Washington. The system shall consist of one master clock, capable of driving 500 units, and 422 secondary clocks, for office rooms.

Chicago, Ill.—Special Castings.—Until 11 a. m., Nov. 12, by Department of Public Works, 317 City Hall, for furnishing 178 tons of special castings.

New Orleans, La.—Elevator.—Until 11 a. m., Nov. 23, by Bureau Yards and Docks, Washington, D. C., for an electric freight elevator for Building No. 6, Naval Station, New Orleans.

Baltimore, Md.—Boiler.—Until 11 a. m., Nov. 13, by James Bosley, M. D., Commissioner of Health, for building and installing one steam boiler in quarantine tugboat, E. Clay Timanus.

New York, N. Y.—Fire Hose.—Until 10:30 a. m., Nov. 11, by Francis J. Lantry, Fire Commissioner, 157 E. 67th St., for eight contracts for furnishing and delivering fire hose, the contracts requiring 35,000 ft. of hose.

New York, N. Y.—Lanterns.—Until noon, Nov. 13, by Col. W. L. Marshall, U. S. Engrs., Army Building, for furnishing reserve lanterns.

Harrisburg, Pa.—Fire Hose.—Until Nov. 11, by C. A. Garverich, for furnishing city with fire hose.

League Island, Pa.—Diving Apparatus.—Until 10 a. m., Nov. 12, by Bureau of Supplies and Accounts, Washington, D. C., to furnish at the navy yard, League Island, Pa., two sets of diving apparatus. Applications for proposals should refer to Schedule 454.

CONTRACTS LET.

The following contracts have been let recently:

Birmingham, Ala.—Electric Railway.—Birmingham & Gulf Construction Co., of which J. A. Vandegrift of Philadelphia, Pa., is President, has been awarded contract for constructing electric railway for the Birmingham & Gulf Railway & Navigation Co. Press reports from Tuscaloosa, Ala., state that George H. Ross and George C. Scales, Engineers of the construction company have been in that city organizing forces preparatory to commencing work in Tuscaloosa.

Ocala, Fla.—Brick Paving—Fitzgerald & Co. for paving streets around court house and adjacent blocks with brick.

Atlanta, Ga.—Filter.—Special Council Committee has voted to accept bid of Continental Jewel Filtration Co., of New York, for constructing additional filter plant. Contract amounts to $26,000.

Waterloo, Ia.—Grading—H. J. Denton has contract for grading for line of projected Iowa & Northwestern Ry., between this place and Anamosa.

Dixon, Ill.—Bridge—Billmire Bridge Co., Rochelle, Ill., at $1,780 for bridge over Willow Creek.

Kankakee, Ill.—Pipe Sewer—Frank Bollin, at $2,548, for constructing 15-in. vitrified pipe sewer in Kankakee St.

De Soto, Ind.—School House—E. J. Hagen, Muncie, Ind., at $15,000, for 8-room school house in this town.

Fort Wayne, Ind.—Ditch Work—Joseph Gusten, at $10,592, for constructing David C. Smith ditch in Maumee and Milan Townships.

Fort Wayne, Ind.—Hotel—Caldwell & Drake, Columbus, Ind., at about $250,000, for erecting hotel here.

Indianapolis, Ind. — Grading — Garfield Greer, at $1,640, for grading approaches to Hoffman Ford bridge in Washington Township; Henry L. Harding, at $2,425, for approaches to bridge on Mt. Nebe Road.

Indianapolis, Ind.—Paving, Etc.—John Arnold for grading and cement walks on Sturm Ave.; Stephen F. Wright for gravel roadway on alley north of 32d St.; Geo. W McCray for brick roadway on alley south of South St.; C. M. Cross for cement walks on Julian Ave.; Marion County Construction Co. for asphalt roadway, curb and gutters on Marlowe Ave.

Muncie, Ind.—Sewer.—W. M. Birch for sewer from Kirby Ave. to railroad track.

Independence, Kan.—Sewer—M. F. Wood, at $1,620, for sewer in Stephenson and Bodwell's addition.

Lawrence, Mass.—Depot—John M. Roche, Haverhill, Mass., for new 700x60 ft. brick freight depot and 80x40 ft. brick office building of B. & M. R. R. to be erected at South Lawrence.

Barnesville, Minn.—Sewers—John McGrath for constructing sewers.

Virginia, Minn.—Sewer—Chas. C. Butler at $3,079 for sewer in District 3-G.

Helena, Mont.—Street Work—Adami Bros. at $2,325, for extending boulevard.

Lumberton, N. C.—Sewer and Water Extensions—F. M. Farrell, Merry Oaks, Chatham County, N. C., at $18,570, for four-mile extension of sewers and a one-mile extension of water mains.

Albany, N. Y.—Paving, Sewer—T. Henry Dumary, at $3,608, for paving Robin St., and John M. Holler, at $1,009, for sewer in Bonheim St.

Cleveland, O.—Concrete Pile Foundations—H. M. North, engineer in charge of construction of the Lake Shore & Michigan Southern Ry., has awarded the contract for the concrete piles for the footings of the Cuyahoga viaduct of the Cleveland Shore Line road to the Raymond Concrete Pile Co. of Chicago and New York.

Guernsey, O.—Sewer.—S. D. Bratton for 1,000 ft. of 21-in. sewer laid 15 feet deep. for Guernsey works of American Sheet and Tin Plate Co.

Dayton, O.—Sewer, Paving.—Shafer & Dill, at $13,260, for constructing sanitary sewers in Wayne, Wyoming and other streets; J. O. Shoup & Co., at $4,038, for macadamizing Robert Boulevard.

Harrisburg, Pa.—Buildings.—G. A. Glenn & Co., Philadelphia, Pa., at $145,200, for constructing two buildings at State Insane Asylum.

Williamsport, Pa.—Paving.—Busch & Stewart for paving Campbell St.

Bloomsburg, Pa.—Electric Road.—Charles Batalgia, Berwick, Pa., for constructing section of Sunbury & Northumberland Electric Ry.

Easton, Pa.—Delaware River Quarry & Construction Co., to repair South Delaware River road at $2.35 per ton for trap rock furnished and placed, and the Bethlehem-Nazareth road at $2.65 per ton.

Reading, Pa.—Subway.—Hawman Bros., at $110,470, for constructing subway at Spring St.

Hastings, Pa.—Bridge.—J. A. Lord, Hastings, at $1,490, for concrete bridge for Cambria County.

Altoona, Pa.—Sewer.—Isaac Bender for constructing sewer in 8th Alley.

Glassport, Pa.—Paving.—Glassport Lumber Co., at $2,216, for paving and curbing.

Harrisburg, Pa.—Disposal Plant.—Brady & Snavely, Harrisburg, at $6,500, for sewage disposal plant at Mont Alto State Reservation.

Spangler, Pa.—Paving.—W. Herr & Co., Altoona, for paving in this place.

Chattanooga, Tenn.—Sewer.—Guild & Co., at $61,213 for constructing storm water sewer in Chestnut St.

Salt Lake City, Utah.—Sewer Pumping Station.—Fairbanks-Morse Co., at $13,375, for installation of new intercepting sewer pumping station.

Ashland, Va.—Bridge.—Stamper Bros. & Ragland, Richmond, Va., at $2,476, for concrete bridge over Chickahomminy River.

Tacoma, Wash.—Water Mains.—Lister Construction Co., at $20,075, for laying water mains.

Fond du Lac, Wis.—Sewers.—S. H. Cole, for extensions to sanitary sewers; also for storm sewer in Armory St.

Fond du Lac, Wis.—Sewers.—S. H. Cole, at $2,761, for constructing several small sewers.

Manitowoc, Wis.—Excavation.—John Maresch, Green Bay, Wis., for excavating a new channel for the Sturgeon River at Loretto, Mich. Work includes removal of about 450,000 cu. yds. of earth and rock.

PROJECTED WORK.

Railroads.

Items Arranged **Alphabetically by States.**

Brunswick, Ga.—Georgia Coast & Piedmont R. R., L. K. Emerson, Superintendent, Darien, Ga., is stated to be preparing to immediately commence active work on the extension of its line to this point. It is understood that the company will construct terminal at this place.

Lewiston, Idaho.—The Northwestern Lumber Co., a Pennsylvania concern recently organized to operate on Craig's mountain, expects to have its plant installed and in operation by July 1, 1907. In connection with the mill a railroad will be constructed. The track and equipment for this road will be brought from Pennsylvania, where the company is operating 30 miles of lumber road.

Elkton, Md.—Pennsylvania R. R. is having surveys made for a route from Worton to Nicholson, and then on to Tolchester and Rock Hall, with a view, it is said, of extending the Chestertown branch to those two points. Alex. C. Shand, Philadelphia, Pa., is Chief Engineer.

Waynesville, N. C.—Elections were held on Oct. 29 in the various counties in North and South Carolina through which the South Atlantic & Transcontinental Ry., is to pass, for the purpose of voting a bonus of $3,000 per mile to the railroad. As projected the road is to have a northern branch from Waynesville, via Asheville to Rutherfordton, N. C., and a southern branch to Greenville, S. C. Col. S. A. Jones, Waynesville, is promoting the project.

Garden City, Kan.—The Kansas & Texas Ry. Co., has been chartered in Oklahoma, with $5,000,000 capital stock. The company proposes to build a railroad from Garden City, via Guymon, Okla., to Amarillo, Tex., and thence southeast to Houston, Tex.. 700 miles. John H. Barnard, Boston, Mass., is the principal incorporator and associated with him are John L. Gilson, C. M. Funk, G. W. Gilson, J. R. McCullough, W. C. Crow and Earl Gilson of Guymon, Okla.

Cleveland, Okla.—The Wichita, Cleveland & Gulf Ry. Co., recently chartered in Oklahoma to build a line from Wichita, Kan., to Port Arthur, Tex., has elected David Ratner, President and R. L. Lunsford, Secretary. The directors voted $50,000 to finish up the survey and for use in preliminary work. The headquarters of the company are at Cleveland, and 50 miles of the road have already been surveyed.

Gotebo, Okla.—The Gotebo & Southwestern R. R. Co., originally chartered with $300,000 capital to build from Gotebo, in Kiowa County, south to Frederick, in Tillman County, has filed an amendment to its articles of incorporation providing for the construction of a 125 mile road from Clinton in Custer County by way of Gotebo to Frederick and increasing the capital stock to $1,000,000. Herbert E. Cloby of Oklahoma City, John W. Onstedt of Cooperton, Peter Richert, Robert B. Wells and R. W. Calhoun, all of Gotebo are the incorporators.

Oklahoma, City, Okla.—Oklahoma, Mexico & Pacific R. R. Co., with main offices in this city and capital stock of $500,000, has been chartered, and proposes to construct 200 miles of road in Oklahoma. The incorporators are: Jos. E. Kerker, T. M. Lindley and C. S. Rice, of Oklahoma City, and J. M. Kroeger and T. D. Kroeger, of Guthrie, Okla.

Monessen, Pa.—Pittsburg & Lake Erie R. R. will lay three to four miles of track for new yards at this place to handle output of Pittsburg Steel Co.

Somerset, Pa.—Plans are being made by the Baltimore & Ohio R. R., for a new freight classification yard to be built on the main line near Somerset. Paul Didier, Allegheny, Pa., is District Engineer, B. & O. R. R.

Memphis, Tenn.—Middle Tennessee R. R. Co., capitalized at $10,000, has filed its incorporation papers with the County Register, at Columbia, Tenn. The charter provides for the road to be built from a point on Leatherwood creek in Hickman county, to the headwaters of Lieper's creek, in Maury County, a distance of nearly 20 miles. The road, when built, will open some valuable phosphate territory. The incorporators are: J. H. Carpenter, J. W. Howard, R. G. Sparrow, Meade Frierson and Arra Holtz.

Nashville, Tenn.—Press reports from this place state local capitalists have decided to at once charter the Tennessee Western R. R., with a capital of $3,000,000, and put engineers in the field to make a preliminary survey. The road is planned to connect with the Nashville and Huntsville at some point in Giles county and then run through Giles, Lawrence, Wayne, Harding, McNairy and Hardeman counties to a connection with Illinois Central at Bolivar, Tenn.

Bristol, Tenn.—Bristol & Kingsport Ry. Co., capitalized at $10,000, has been chartered. J. B. Cox, F. Powell, F. H. Catteron and S. I. King are interested.

Knoxville, Tenn.—Promoters of Knoxville, Sevierville & Northeastern Ry., will submit proposition for building line provided people of Sevier County, Tenn., will vote aid to the project. The line is to run across the mountains into North Carolina, and three routes have already been surveyed for that portion of it between Knoxville and Sevierville. W. J. Oliver, Knoxville, is reported to be interested.

Taylor, Tex.—Entire right of way from Taylor to Somerville for the proposed Taylor, Somerville & Gulf R. R., has been secured and steps have been taken for the early construction of the road. J. A. Thompson, Taylor, is President.

Pasco, Wash.—County Commissioners have granted petition of Portland & Seattle R. R. Co., now under construction, for the vacation of a number of streets and alleys in Pasco for new switchyards. There will be about 200 miles of track in the yards.

Spokane, Wash.—Idaho & Washington Northern R. R., F. A. Blackwell, President and J. T. McDevitt, Secretary, has executed a mortgage for $5,000,000 to secure funds for construction and equipment of its line from Spirit Lake, where a model town is being built, to Newport, thence down the Pend d'Oreille River, in Stevens County, Wash., north of Spokane.

Electric Railways.

Items Arranged Alphabetically by States.

Birmingham, Ala.—Tidewater Development Co., J. M. Dewberry, President, has transferred its franchise and rights of way for an electric railway to the recently organized Birmingham & Gulf Railway & Navigation Co., and work on the new electric line between Tuscaloosa and Gadsden will be started at once. The contract for constructing and equipping the line has been let to the Birmingham & Gulf Construction Co., of which J. A. Vandegrift, Philadelphia, Pa., is President. George C. Scales and George H. Ross, Engineers of the Construction company were in Tusaloosa, Ala., the latter part of October organizing a force to electrify the Tuscaloosa Belt Line Ry., which will be the first work to be done. Work will then be started in Birmingham and a line built to Ensley and Pratt City.

Pine Bluff, Ark.—Surveys have been completed from Little Rock to this place for the Little Rock-Pine Bluff Interurban line. W. H. Waugh is Engineer in charge of surveys.

Corona, Cal.—Efforts are being made to induce the Pacific Electric Ry. Co., to build an extension to this place from Arlington, the present terminus, eight miles distant.

Macon, Ga.—Line of projected Macon, Americus & Albany Electric Ry., has been definitely located and it is said that actual construction work will be started at an early date. The Macon & Albany Securities Co., Grand Bldg., Macon, is backing the project.

Marshalltown, Ia.—Citizens of this place have raised $50,000 for preferred stock in the interurban railway promoted by Hamilton Browne, 79 Dearborn St., Chicago, Ill. The line as projected is to run from this city to Melbourne and in time to become a part of the line out of Des Moines for the north.

Lewiston, Idaho.—Advices from this city state that the Spokane & Inland Electric Railway Co., will begin an extension of its road to Lewiston and Clarkston, next spring. The route followed will be down the Steptoe canyon, reaching the Snake River, nine miles below Lewiston. From that point the road will parallel the Oregon Railway & Navigation Co.'s line up the river to the mouth of Dry gulch, where it will cross the river at Clarkston, thence by means of a high bridge again cross the river to Lewiston.

Chicago, Ill.—Chicago, Fox Lake & Lake Geneva R. R. Co., capitalized at $200,000, has been incorporated and proposes to construct an interurban electric railroad from Chicago to Lake Geneva, with branches to Fox Lake and Woodstock. The incorporators and first board of directors are George

M. Seward and Sidney F. Malette, brokers in the Stock Exchange Bldg.; Lewis E. Starr, wholesale lumber dealer, Stock Exchange Bldg.; Maurice B. Louis, Secretary, Chicago, Des Plaines & Fox River R. R., and Harry Y. Yaryan.

Belleville, Ill.—With principal office at this place and capital stock of $100,000 the Belleville & Interurban Ry. Co., has been incorporated, and projects the construction of a line from Belleville to Smithton. Jacob Gundlack, Jr., Geo. Hippard and Thos. A. Bell are interested.

Murphysboro, Ill.—Murphysboro & Interurban Ry. Co., has applied for charter and proposes to build an electric railway in and around this place and to Carbondale. The sum of $50,000 has already been subscribed. Those interested: A. B. Minton, owner of the "mule car line," now in operation here; Willard Wall, banker; W. C. Alexander of the Murphysboro Ice & Cold Storage Co.; John G. Hardy, banker; P. H. Eisenmayer, President of the Southern Illinois Milling & Elevator Co.

Evansville, Ind.—Preliminary surveys are now under way for the extension of the Evansville and Boonville traction line from Boonville by way of Chrisney, Newtonville, Troy, Tell City and Cannelton, Ind. The distance from Chrisney to this city by the proposed line will be 30 miles. C. C. Watts, Princeton, Ind., is Engineer.

Decatur, Ind.—Fort Wayne & Springfield Ry. Co., A. W. Fisbaugh, Chief Engineer, Decatur, will soon advertise for bids, it is said, for the construction of the contemplated extension of the road from Decatur to Berne. The length of this extension is 12 miles and in the right of way there are three streams which must be bridged.

Ardmore, Ind. T.—The Ardmore Traction Co., with capital stock of $500,000, backed by local and eastern capital, has been organized here for the purpose of either purchasing the line of the present Ardmore Street Car Co., or procuring a franchise for the installing of another line.

Mirabile, Mo.—Missouri Valley Traction Co., which proposes to build a trolley line from St. Joseph to Excelsior Springs and to Mirabile, Mo., has been chartered. Among those interested are Geo. Kidd, Excelsior Springs, Mo.; Geo. M. Morris, Mirabile, and J. J. McDonald, St. Joseph, Mo.

Fairmont, Minn.—G. E. Doyle, Fairmont, is promoting a project for an electric line from this place to Fort Dodge, Ia.

Hendersonville, N. C.—Preliminary surveys have been made and right of way secured for the Asheville & Hendersonville R. R. Co., C. F. White, Treasurer, which proposes to construct a 22-mile interurban road between this place and Asheville.

Millersburg, O.—Work is to be started within a few weeks, it is said, on the construction of a trolley line between this place and Beach City, a distance of 26 miles. The Millersburg & Eastern R. R. Co., was recently incorporated for this purpose. Among those interested are: O. S. Olmstead, Dan M. Miller, W. W. Adams, of Millersburg, and Samuel P. Dunn and J. A. Burke, of Cleveland.

Albany, Ore.—A. Welch has formally accepted the franchise recently granted him to use several streets in this city for an electric car line, and has announced that work would soon begin. Under the terms of the franchise work must commence on the line within six months and it must be completed within 18 months. The new line will cover the city thoroughly, as well as connect with the Salem-Eugene electric line, for which a survey is now being made.

Butler, Pa.—Butler & Chicora Street Ry. Co., Butler, has been chartered to build line 15 miles long; capital is $90.000. John Daly, Pittsburg, is President and the Directors include: W. C. Criswell, Crafton; W. J. Horgan, Homestead; W. E. Stern, Avalon, and E. W. Dewey, Brady's Bend.

Saxonburg, Pa.—Butler, Saxonburg & Tarentum Street Ry. Co., of this place has been chartered with capital of $150,000, and proposes to build a 24 mile line. Those interested: James Cringliano, Saxonburg; Otto W., Emil F., and Edward C. Rudert and John E. Muder, Saxonburg.

Edgefield, S. C.—Charter is to be applied for at January session of General Assembly for a trolley line to be built from North Augusta to Edgefield and north. B. E. Nicholson, Edgefield, is chairman of the committee and has full power to make arrangements to provide for a survey of the routes as soon as it has been determined, as well as rights of way.

Covington, Tenn.—Construction of electric road from this place to Memphis is proposed and charter has been applied for by the Memphis, Covington & Northern Electric Ry. Nominal capital stock is to be $14,000, which wilil be used for preliminary surveys and securing right of way. Among those interested are: G. B. Gillespie, John T. Garner, and W. H. Bingham.

Houston, Tex.—Houston Electric Co., Flint McGregor, Engineer, has been granted franchise for an extension of its line to a point near Harrisburg.

Seattle, Wash.—Recently incorporated Seattle-Tacoma Short Line Ry. Co., will shortly commence work on the construction of its interurban road between this place and Tacoma. Contracts for the first five miles were to be let at once. The company which has offices at 415 American Bank Bldg., Seattle, and 610 Perkins Bldg., Tacoma, has a capital stock of $6,000,000. Merle J. Wightman, 302 Broadway, New York, is Vice President of the company and will be Resident Engineer in charge of construction.

Appleton, Wis.—Surveys have been completed and capital stock secured for the construction of an interurban line between this place and Fond du Lac. John Seman, Sheboygan, Wis., is interested.

Sewers.

Items Arranged Alphabetically by States.

Anna, Ill.—Charles W. Brown, C. E., Jacksonville, Ill., is preparing estimates of cost of installing sewer system for this city.

Glencoe, Ill.—Village Council has plans under consideration for a sewage disposal plant. As proposed the north and south sewer systems will lead into a septic tank at the southwestern edge of the village.

Marion, Ind.—Plans and specifications are being made for the construction of sewers in western part of this city to cost $32,000.

Richmond, Ind.—Board Public Works will call for bids in December for constructing two sections of sewer to cost about $23.000.

Gary, Ind.—Extension of sewer system to South Gary is under consideration. A. P. Melton is City Engineer.

Hutchinson, Kan.—City Engineer Elbury will shortly start surveys for a large sewer to be constructed in northeast part of city.

New Bedford, Mass.—City Council will order construction of sewers in Belleville Road, Howard Ave., and Wood and Covell St. Cost of work is estimated at $50,300. A sewer will also be built in the street leading to the Nonquitt Mill at a cost of about $13,654.

Strugis, Mich.—This city is considering installation of sewer system and sewage purification plant. George S. Pierson, Kalamazoo, Mich., is Engineer.

Battle Creek, Mich.—Board Public Works has recommended construction of sewers and water main extensions to cost $7,000.

Port Huron, Mich.—City Engineer is preparing estimates of cost of sewering the 9th Ward.

Joplin, Mo.—Issuance of $160.000 of bonds is to be voted on. Part of this amount will go for the construction of the Willow Branch storm sewer and for a sanitary sewer in western part of city.

Sparks, Nev.—City is to have a septic tank constructed.

Albuquerque, N. Mex.—City Engineer has practically completed plans for new sewer system for this city.

Madison, N. J.—This place has voted in favor of installing sewer system.

Trenton, N. J.—State legislature has passed bill allowing city of Paterson, N. J., to construct its own sewage disposal plant in an adjoining county.

Lockport, N. Y.—City proposes to construct a sewer in Wheatfield to cost about $5,000.

Easton, Pa.—Construction of sewage disposal system for this city is proposed. A. Prescott Folwell, Flatiron Bldg., New York, is Consulting Engineer.

Schuylkill Haven, Pa.—G. W. Butz, C. E., is making surveys and estimates for a sewer system for this place.

East McKeesport, Pa.—State Board of Health has disapproved Borough Council's plan for a sewer system to empty into Turtle Creek. Borough is given until June 1 to find some method of sewage disposal.

Wilkesbarre, Pa.—City Engineer has plans under way for a storm sewer in the eastern section of the city to take the place of the old Lehigh Valley Canal bed sewer.

Hubbard, Tex.—City Council has appointed committee to consider issuance of bonds for constructing sewer systems.

Kenosha, Wis.—Street Assessment Committee has been instructed to take steps to revive the old scheme for a trunk sewer along Jordan Creek.

Toronto, Ont.—City Engineer has recommended the construction of high and low level intercepting sewers, and the classification of the sewage by means of septic tanks and contact beds. The propject would involve the expenditure of $3,400,000.

Collingdale, Pa.—Borough Council is considering construction of sewer system.

Erie, Pa.—Erie Improvement Co. has asked for a charter and proposes to construct sewer system in Millcreek and Harbor Creek Townships. J. M. Sherwin and F. C. Pratt, Erie, are interested.

Kane, Pa.—Local sewer system is to be extended.

Scranton, Pa.—Mayor has authorized construction of Forest Court sewer.

Brodhead, Wis.—City is to construct sewer system. W. G. Kirchoffer, Madison, Wis., is Engineer.

Waukesha, Wis.—Installation of $26,000 sewer system is under consideration.

Water Supply.

Items Arranged Alphabetically by States.

Luverne, Ala.—Surveys have been made for water works for this place.

Tampa, Fla.—Tampa Water Works Co. is negotiating for the purchase of the water works system established some time ago by Eugene Holtsinger.

Hazlehurst, Ga.—Election is to be held Nov. 25 to vote on issuing $25,000 of bonds for building water works and sewer system.

Rome, Ga.—City Council will vote on issuance of $150,000 of bonds for water works and sewer extensions.

Lamoni, Ia.—Plans have been prepared for water works for this place to cost $20,000. W. K. Palmer, Kansas City, Mo., is Engineer.

Anna, Ill.—Anna Water Works Co. has been granted franchise and is now asking a charter. Company is to have capital stock of $14,000. H. P. Tuthill, George Sanford and J. N. Dickinson are interested.

Antioch, Ill.—Plans are being considered for installation of water works for this place.

Deer Creek, Ill.—This place has voted on special tax for installing water works.

Rock Falls, Ill.—Municipal water works are under consideration.

Winnetka, Ill.—Extensive improvements are planned for local water works.

Wolcott, Ind.—Citizens have voted to construct water works at a cost of $10,000.

Welsh, La.—Citizens Ice & Water Works Co., has been organized with $25,000 capital stock. Plant is to be erected.

Morenci, Mich.—Installation of water works here is under consideration.

Fowlerville, Mich.—Special election was held Oct. 28 to vote on issuing bonds for water works.

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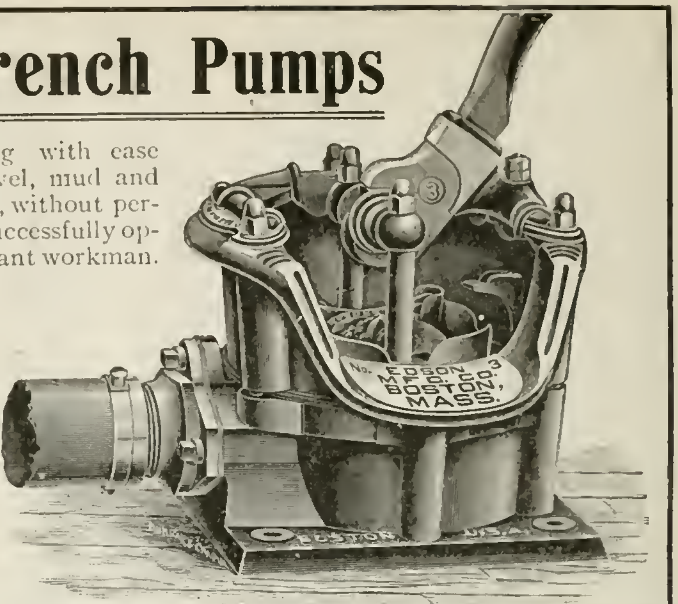

RETAINING WALLS AND PAVING W. HARRISON STREET.

Department of Public Works,
Chicago, October 28. 1907.

Sealed proposals will be received by the city of Chicago until 11 a. m., Tuesday, November 12. 1907, at room 224. city hall, for furnishing all labor and material and for paving with No. 2 granite blocks and for building certain retaining walls in W. Harrison street, from S. Canal street to S. Clinton street, and in a part of S. Canal street, near the intersection of Canal street and W. Harrison street, according to plans and specifications on file in the office of the Department of Public Works of said city. room 225, city hall.

Proposals must be made out upon blanks furnished at said office and be addressed to said department, indorsed "Proposals for Retaining Walls, Etc., W. Harrison St.," and be accompanied with one thousand dollars in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago and made payable to the order of the commissioner of public works.

The commissioner of public works reserves the right to reject any or all bids.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the commissioner of public works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

JOHN J. HANBERG,
Commissioner of Public Works.
By PAUL REDIESKE,
Deputy Commissioner of Public Works.
19-1t

LEVEE WORK—Mississippi River Commission, 1st and 2d Districts, U. S. Engineer Office, Room 20, Custom House, Memphis. Tenn., Oct. 25. 1907.—Sealed proposals for about 190,000 cubic yards of levee work and 40,000 cubic yards of drainage ditch in Upper St. Francis levee district will be received at this office until 12 o'clock m., Nov. 25, 1907. and then publicly opened. Information furnished on application. WM. D. CONNOR, capt., engrs.

RAILROAD WORK.

St. Louis, Mo.

The Missouri & North Arkansas Railroad Company has 650,000 cu. yds. of side borrow and three miles of pile trestle to let on 28 miles of their extension between Kensett and Cotton Plant, Arkansas.

W. S. DAWLEY, Chief Engineer.
820 Security Building, St. Louis, Mo.

NOTICE TO CONTRACTORS.

Dancy Drainage District,
Wausau, Wisconsin.

Sealed bids will be received by the Commissioners of the Dancy Drainage District at the office of the Clerk of the Circuit Court in Wausau, Wisconsin, until 2:00 o'clock p. m., Tuesday, December 3d, A. D. 1907, at which time and place the Commissioners will attend and publicly open said bids.

The work upon which bids will be received are the Main Ditch and all of the branch ditches proposed to be constructed, plans for which have been heretofore approved by the Court.

Payments will be made in cash on monthly estimates to the extent of 80% of the work done during the preceding month and final payment upon the completion and acceptance of the work.

Plans, profiles and specifications are on file and may be seen at the office of the aforesaid Clerk of the Court, at the office of the Secretary of the Board of Commissioners at Dancy, Wisconsin, at the office of the Harman Engineering Co., 109 South Jefferson Ave., Peoria, Illinois, and at the rooms of the Western Society of Engineers, Monadnock Bldg., Chicago, Illinois. Copy of Specifications, Form of Bid and Form of Contract may be procured by calling upon or addressing the Harman Engineering Co.

The Commissioners reserve the right to reject any and all bids.

GEO. H. REYNOLDS,
J. P. MALICK,
GEO. G. KNOLLER,
Commissioners.
HARMAN ENGINEERING CO.,
Engineers, Peoria, Illinois.
October 28, 1907. 19-2t

PAVING.

Hot Springs, Ark.

Sealed proposals will be received for street paving in Improvement District No. 21 and Imp. District No. 26, City of Hot Springs, Ark.

Approximately 10,000 sq. yds. with either Asphalt, Bitulithic or Vitrified Paving Block, on six-inch concrete base.

Proposals to be opened Nov. 20th, 1907.

Also approximately 5,000 sq. yds. with Vitrified Paving Block, between St. R. R. Tracks, in above Imp. Dists.

For further particulars, plans and specifications, address,

F. V. P. ELLSWORTH,
City Civil Engr.,
Hot Springs, Ark.

MUNICIPAL CIVIL SERVICE COMMISSION,
299 Broadway.
New York, October 31, 1907.

PUBLIC NOTICE IS HEREBY GIVEN that applications will be received from THURSDAY, OCTOBER 31, UNTIL 4 P. M., WEDNESDAY, NOVEMBER 27, 1907, for the position of

TOPOGRAPHICAL DRAFTSMAN.

The examination will be held on Thursday, December 19, 1907, at 10 a. m.

The subjects and weights of the examination are Technical, 5; Experience, 2; Mathematics, 2; Neatness, 1.

Vacancies constantly occur. The salary is $1,200 per annum and up.

The provision of clause 12 of Rule VII., to the effect that "no person who has entered any examination for appointment to a competitive position and failed therein or who has withdrawn therefrom, shall be admitted within nine months from the date of such examination to a new examination for the same position," is waived so far as it applies to this examination.

For further information apply to the Secretary.

19-3t FRANK A. SPENCER, Secretary.

U. S. ENGINEER OFFICE, Portland, Oreg., Oct. 18, 1907. Sealed proposals for furnishing and delivering four hoisting engines, three locomotives and two boilers will be received here until 11 a. m., Nov. 18, 1907, and then publicly opened. Information furnished on application. S. W. ROESSLER, Lt. Col., Engrs. 17-4t

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U. S. ENGINEER OFFICE, Riegler Building, Little Rock, Ark., Oct. 16, 1907.—Sealed proposals for 248,000 cubic yards of levee work opposite Pine Bluff on Arkansas River, Ark., will be received at this office until 11 o'clock a. m., November 16, 1907, and then publicly opened. Information furnished on application. WM. D. CONNOR, Capt., Engrs.

Solving Sewer Problems

In any sewer system, large or small, obstructions and stoppages are bound to occur. A comparatively small obstruction may cause an aggravating amount of work and unnecessary expense, simply because one is without the proper tools to get right at the trouble at once.

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SEPTIC TANK AND PUMPING STATION.

North Milwaukee, Wis.

Sealed bids will be received by E. H. Klamp, Village Clerk, until 7:30 p. m., Nov. 11, 1907, for the furnishing of all material and labor for the construction of a septic tank made of concrete, 42 ft. in diameter by 16 ft. deep with brick house 18 ft. in diameter by 10 ft. high, erected above it. Each bid must be accompanied by a certified check for 5 per cent of the amount of the bid. A bond of 50 per cent will be required of the successful bidder.

Plans and specifications may be seen on and after Nov. 4, at the village hall, North Milwaukee, Wis., at 31 Vroman Bldg., Madison, Wis., and at the Builders & Traders' Exchange, Milwaukee, Wis. The right is reserved to reject any or all bids.

W. G. KIRCHOFFER, Engineer.
Madison, Wis.
E. H. KLAMP, Village Clerk,
18-2t North Milwaukee, Wis.

TRUNK SEWER AND TUNNEL.

White Plains, N. Y., Oct. 10, 1907.
Office of the Commission, No. 2 Grand St.

Pursuant to the provisions of Chapter 646 of the Laws of New York, 1905, as amended by Chapter 747 of the Laws of 1907.

SEALED BIDS, addressed to the Chairman of the Bronx Valley Sewer Commission and accompanied by a certified check for at least five per cent of the amount of security required for the faithful performance of the contract for each section bid upon, will be received up to November 7, 1907, at one-thirty P. M., for furnishing all the work and materials necessary for the watertight and enduring

CONSTRUCTION of each one of the seven sections which together comprise about twelve miles of circular sewer from three and one-third to six feet in diameter and about three miles of circular lined tunnel mostly six and one-half feet and eight and one-half feet in diameter. The material to be either monolithic reinforced concrete, reinforced concrete blocks or brick masonry.

PLANS and specifications may be seen at the office of the Commission. The Invitation to Contractors, the Form for Bids, the Specifications and the Form of Contract and Bond may be obtained from the Secretary of the Commission upon the payment of one dollar, to be repaid when the same are properly used in bidding.

FORM OF BID must fulfill the requirements of the Invitation and be made out upon the printed Form of Bid as above obtained and the Commission reserves to itself the right to reject any or all bids or to accept that one or those whose acceptance will, in its judgment, best secure the public interest and the efficient performance of the work mentioned.

FRANK N. GLOVER,
Secretary.
Office of the Commission, No. 2 Grand St.,
White Plains, N. Y., October 10, 1907.

Postponement of Date.

The time for opening of bids for the construction of the Bronx Valley Sewer is extended to Wednesday, November 27, 1907, at 1:30 p. m., at No. 2 Grand St., White Plains, N. Y.

19-3t FRANK N. GLOVER, Secretary.

PROPOSALS FOR WATER PIPE.

Office of the Superintendent of the Water Department of the City of Phoenix, Ariz., September 25, 1907.

Separate bids will be received by the Superintendent of the Water Works of the City of Phoenix, Arizona, at the office of the said Superintendent, up until 3:30 p. m., of December 1, 1907, for the following:

1. Furnishing all material and labor for the completion of contemplated improvements.
2. Supplying material only.
3. Necessary work for the installation of the same.

Specifications can be obtained, upon application, from the Superintendent, at City Hall, Phoenix, Arizona.

A certified check for five per cent of the amount of the bid, made payable to Frank Thomas, Recorder for the City of Phoenix, is to accompany each proposal, to be held as a guarantee that a contract with bond approved by him will be entered into by the party whose bid is accepted, in accordance with the terms of the said bid.

The Superintendent reserves the right to reject any or all bids, in whole or in part.

ROBT. CRAIG,
Superintendent

PROPOSALS FOR STREET PAVING.

Columbia, S. C.

Proposals will be received by the Street Commission of the City of Columbia, S. C., until 12 o'clock m., November 25th, 1907, for paving Main Street with either Vitrified Brick, Wood-Block, Asphalt or "Bitulithic."

The work will embrace approximately 65,000 square yards of pavement, 17,000 lineal feet of combined concrete curb and gutter, and 4,500 lineal feet of concrete storm drains.

Plans are on file and may be seen at the office of the Street Commission at Columbia, or at the office of the Engineer at Winston-Salem, N. C.

Specifications will be ready and may be obtained from the Engineer after Oct. 30th.

Proposals will be opened publicly with the usual rights reserved.

J. L. LUDLOW, Engineer,
Winston-Salem, N. C.
CHAS. NAREY,
18-3t Chairman St. Commission.

Eastern Headquarters:
415 Water St. Pittsburg, Pa.
THOS. GRADY, Sec'y.

12 Fifth St. Bayonne, N. J.
JOSEPH BRADY, Sec'y.

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WANTED—Position. A well known chief engineer, 50 years of age; having had 30 years' experience on location, construction, and other railway work, is looking for change. Is especially well fitted to investigate projects and prepare estimates for investors. Address "W. P.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

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WANTED—Mechanical engineer now in the East desires position in New Mexico or vicinity. Will start at $125 with contractor who is looking for an experienced superintendent or engineer. Best of references. Address "D. J. W.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

SITUATION WANTED by superintendent and foreman, 33 years of age, having had practical experience on building construction, grading, concrete and cement work. Also as assistant on railroad and municipal surveys. Familiar with instruments. Preference, Southern location. Address "B. H. C.," care of Engineering-Contracting, 355 Dearborn St., Chicago. 19-2t

WANTED—Architectural draftsmen, Structural steel-work draftsmen, Electrical draftsmen, and Mechanical draftsmen. A competitive examination will be held simultaneously at the Navy Yards, Boston Mass., Brooklyn, N. Y., League Island Pa., Washington, D. C., Mare Island, Cal., Puget Sound, Wash., and at Chicago, Ill. Cincinnati, Ohio, St. Louis, Mo., Denver, Colo., and Pittsburg, Pa., December 2 and 3, 1907, for the purpose of establishing an eligible register for the above positions. Applicants desiring to take the examination at any of the Navy Yards will address their applications to the Commandants of such Yards. Those wishing to take the examination at Chicago, Ill., Cincinnati, Ohio, St. Louis, Mo., Pittsburg, Pa., or Denver, Colo., will address their applications to the Secretary of the Navy, Washington, D. C. All applications must be delivered to the proper officer on or before November 20, 1907. 17-21

RAILROAD SHOP TOOLS—Having purchased six acres of ground for shops for repairing locomotives, rebuilding cars, making frogs, switches, etc., we desire to hear from manufacturers of machinery for such works. Railway Equipment Co., 324 Chamber of Commerce, Portland, Ore.

WANTED—Position — Railroad draftsman having had two years' experience with railroad location parties, wishes new position. Address D. C. Hall, 1619 Summit Ave., Seattle, Wash. 18-3t

WANTED—Position with Contractor as Engineer or Superintendent railroad work preferred. Twelve years' first class experience; can handle any job of earth moving or concrete work, steam shovel, and heavy masonry. Can report in twenty-four hours. Address "F. G. A.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

WANTED—Position—Young Engineer twenty-nine; has principally acted for last three or four years as Transitman and Chief of Party on railroad location; recently Chief of Party on very heavy work in Ohio; available immediately; salary expected, $90 and expenses. Can report on or after October 30th. Address "C. P. T.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

ENGINEERING CORPS, open for engagement, Nov. 10. Preliminary, location or construction. Steam or electric lines. All instruments. Twenty years' experience. Best of references. Address D. B. Metcalf, Box 10, Salamanca, N. Y. 19-2t
ing, 355 Dearborn St., Chicago. 19-3t

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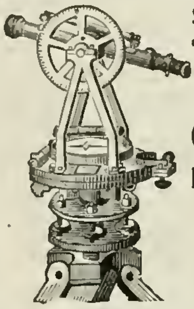

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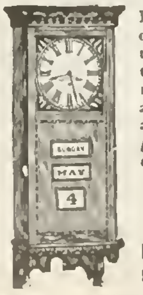

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Contractors Suffer from Lack of Law Knowledge.

Contractors undertaking public contracts should always post themselves on the enabling acts under which the work is done, the appropriations made for the work, and all other essential details. This is absolutely necessary to be able to enforce payment for the work done.

Our attention is called to this subject by a recent California court decision, wherein a contractor for some sewer work, done under the "Vrooman act," cannot recover.

The case at issue was whether the description of the work in the contract, and upon the engineer's plans, agreed with the ordinance of intention. The court decided that the description did not tally, hence there was no authority for the work, and the contractor cannot be paid. This is no direct fault of the contractor, yet the contractor is the one to suffer.

The act of the legislature that affects southern California on such construction work, known as the "Vrooman act," is a freak piece of legislation. As we understand it, the act provides for the towns and cities letting work to contractors, who are given warrants for work when it is finished. These warrants are not paid by the city but the contractor is compelled to collect them from each and every property owner.

We have heard of contractors being made to do many unreasonable and surprising things, but this is the first time that it has been brought to our attention that a contractor is made a tax collector in order to be paid for his work. Naturally this act prevents all small contractors from bidding on construction work, as only firms that can carry their payrolls and other expenses until the job is completed can afford to bid. This invites collusion between a few contractors, and they can make the cities pay a handsome price for having their taxes collected, and applied to paying for work that may have been done for some months. The rate of interest they charge for waiting for their money is not likely to be small.

It is true that contractors should be protected from such freak legislation. We know of no way in which they are likely to be so protected except through the new American Society of Engineering Contractors that is now being organized. Over 600 contractors and engineers have applied for membership in the organization. If you have not already sent in your application, cut out the coupon appearing on one of our advertising pages and mail it today. Announcement as to the permanent organization of the society will soon be made.

Two Ways of Exercising Foremanship

Supervision has a particularly important part in concrete work. The frequently reiterated statement that concrete work can be done by common labor whereas steel and timber and masonry construction require skilled labor is true only if we get the meaning correctly. The correct meaning is not that skill is not required in concrete construction, it is that one skilled foreman can so direct the work of a score of common laborers that a safe and durable structure can be built of concrete where stone cutters, housesmiths and carpenters have never been heard of. In a word concrete work is work involving skilled supervision but not necessarily involving skilled workmen in the sense that stone cutters and metal workers are skilled.

The lesson of the fact just stated should be carefully studied in choosing foremen for concrete work. It is a supervisor of workmen that is wanted, not an additional workman with more skill than his fellows. It goes without saying that the foreman must be skilled in concrete work, but his function is to use his skill in directing and, when necessary, in teaching other people, not in doing actual work. It is his brains and not his hands whose service is wanted.

These somewhat trite assertions have been suggested in part by the remarks of Mr. H. F. Porter on "supervision" toward the close of his interesting paper printed in another column of this issue and in part by two incidents observed by one of the editors in a recent inspection of a large job of concrete work. The remarks of Mr. Porter speak for themselves, but the observations of the editor may deserve a few words of explanation.

The work inspected was a large job of reinforced concrete work requiring considerable form construction and some careful wiring and spacing of reinforcement. The work under two foremen was observed particularly. One man was pointed out with the introductory remark that he was "the best workman in the business." Proof that he was a good workman was furnished by watching him for half an hour at his work. He could do as much work as any two of the men under him and he was doing it and doing it better than they could. His record of progress was not high, however, it was remarked,—"he had a poor gang."

The next man was sitting on a nail keg when visited and he sat there all the time the visitor was watching his work, but the nail keg was located so that the "boss" could see every man on the job. He hadn't nearly as much experience as the first man, the visitor was told, and at first he was way behind the first man in the progress of his work, but "he had a good gang" and had caught up with and was now beating out the first man.

Now it was developed by inquiry that both of these foremen had been furnished with gangs from the same lot of men by simply dividing the lot into two parts haphazard. They started even so far as the kind of men in their gangs was concerned, but at the end of two weeks one man had a "good gang" and the other man had a "poor gang." Was one foreman simply lucky in getting good men while the other was unlucky? Inquiry did not indicate this. What it did indicate was that one man had at first spent much of his time and the time of his men in instruction. He had divided up his gang and had taught each division what it had to do and how to do it. During this schooling, progress had been slow, but pretty soon a body of well trained men had been developed and then progress speeded up until, as before stated, it was far ahead of that being made by the foreman who had started with just as good men and far more personal skill.

This account of the record of two unknown foremen is not given because it is unique at all, but because it illustrates a principle in foremanship. Supervision of work and instruction of workmen are the duties of the foreman. It may take the foreman longer to teach a man how to do a thing than to do it himself, but it is cheaper in the long run to teach the man.

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Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Faults of Reinforced Concrete Design and Construction.

BY H. F. PORTER.*

What are the avenues through which errors enter into concrete steel construction to cause weaknesses and possible failures? They may be summarized under three general headings: First, carelessness or ignorance in design; second, carelessness or ignorance in installation; third, a combination of both.

The failures last year were undoubtedly due very largely to errors in construction, yet faults in design certainly contributed largely also. This we must expect while the design of important structures is in the hands of inexperienced or unqualified designers, and the building laws of our land are crude and insufficient.

Even in the larger cities, like Philadelphia and New York, where the building regulations regarding concrete steel have been perfected as fast as the rapid developments of the art have permitted, grave errors creep in. The main faults are lack of attention to the details, both of design and installation. For many designers consider their task done when the bending moment is figured out. The adjustment of the moments of bending and resistance is the simplest part of the problem. The questions of internal stresses, temperature strains, and negative bending tendencies, influences resulting from the monolithic action of the material—all are questions of vital importance and demand careful investigation. The building codes are practically all offenders in these respects, in that while fixing certain unit stresses and bending moments, they fail to regulate the problems of details.

Suppose the law says—as is the letter in the majority of our cities to-day—that beams shall be calculated as freely supported, for which the bending moment is ⅛ W L, where L = clear span and W = total load, dead and live, carried by the member; but says nothing about the strains existent about the supports which must obtain because of the character of the material. The designer who thinks his duty done when he has sufficient area of steel in bottom of beam to satisfy these requirements takes chances.

While beams may be considered as freely supported, there can be no gainsaying that continuity of action is realized to a greater or less extent. It is certainly good engineering to provide against the worst case. Therefore, as perfect continuity of action must obtain under certain conditions enough steel should be provided over the supports to satisfy the maximum negative bending moment, which is equal to 1/12 W L, and it must be insisted upon in the field that as much care be taken in placing the top steel as in placing the bottom steel. Constructors seem unable to comprehend this point and think that if the bottom steel is all right it matters little about that over the supports. Failure in two instances last year showed in diagonal cracks extending upward and away from the supports, showing the inadequacy of top reinforcement as well as shear reinforcement. It is the writer's candid opinion, based on experience, that whether the building law says so or not, all reinforced concrete should be designed to meet the conditions of perfect continuity as well as partial continuity. Structures should be so well tied together across supports that abrupt breaking out of a section would be impossible and failure could only occur by the structure gradually sinking under an increasing load.

Other common faults in design are failure to secure necessary compressive area of concrete; neglect to provide reinforcement in the slab over girders figured as T-sections intersected by beams where there is an integration of compressive stresses due to combined action of slab and girder flange. Reinforcement should in this case be provided to carry the loads directly to the girder and not through the intermediary of slab and intersecting beam. Neglect to provide suitable connection between the stem and flange of a T section, so as to safeguard against horizontal shear where the slab and rib join, and to ensure the action counted upon as a T section is another fault.

The rib is often made too narrow for its depth and the slab too thin for the depth of the beam. Unless these things are carefully and intelligently investigated, only simple rectangular beams should be attempted, for failures are bound to result.

Another common weakness in design, due to the drive of competition, no doubt, is to crowd the steel. Insufficient fireproofing and insufficient separation of the bars to afford proper adhesion and to allow for the irregularities of installation are all too common. This tendency to skimp must be arrested, or failures will have to be chalked up on this score.

Another common fault is the use of bars of too large a diameter for the length of the beam. At least 80 diameters must be had on either side of the mid span if the steel is to be developed at 16,000 lbs., and it is probably safer never to have the bars exceed in diameter 1/200 the span in inches If plain bars are used it is also quite necessary to extend the length a sufficient distance into the adjacent span to provide for the proper development of the section at every point from the center to the support as a further precaution to provide the ends of all plain steel with hooks. In event of vibratory loads or heavy and oft-repeated loadings and unloadings, all of which tend to weaken the bond, the hook becomes indispensable. This fault is common in footings and as it is the dictum of some engineers to use large diameters because of the reduced labor of handling the material; this tendency demands watching. There is little question but that a large number of rods of small section are to be preferred for strength and safety to a fewer number of larger rods, for with the small rods the adhesion is usually abundantly in excess of the tensile strength.

The new St. Louis code covers many of these common faults of design fairly well and is the sanest and safest code of regulations for the design of concrete steel yet compiled. It is still, however, not specific and rigorous enough on many points.

As to weaknesses in installation, those due to carelessness in allowing foreign ingredients to remain in the molds, such as sawdust, blocks of wood, dirt, etc.; carelessness in placing the steel and in tamping the concrete around it; carelessness in placing the steel in its designated position and in taking measures to maintain it there during the sequence of operations—all these were elements of disaster all too apparent in last year's failures. Molds must be made thoroughly clean and flushed well immediately prior to placing the concrete, and the steel should be placed in the calculated position and held there until the stiffening concrete locks it forever. This applies to beam and column reinforcement as well as to slab reinforcement. If loose rods be used in slabs, enough of the intersections of carrying and distributing rods should be clamped firmly and rigidly supported at the proper height above the centers to insure them remaining where intended until imbedded finally. This measure should be so effectively done that the wheeling and walking over the rods after once spaced would in nowise disturb them.

When once begun, concreting should proceed without interruption until the entire section is completed. Breaks in the work, even only 24 hours old, are hard to knit, and should not be tolerated. If it should become necessary, however, to interrupt operations, the stop should be made either at the middle of a slab, leaving a perfectly plain vertical face on the concrete, or over the center of a beam. In the latter case, the member should be divided in twain longitudinally by a partition and one-half cast completely, only enough concrete being run into the other half to cover the rods thoroughly. Plenty of tie steel should be provided in the top of the slab to reach into the new concrete. This with the stirrup at the bottom of the beam should suffice to hold the halves together. Each half will thus be a perfect L section, with no planes of set except where no weakness is introduced. Too many constructors are in the habit of filling the entire beam, sloping off on the one side. This leaves a few inches only of stirrup to dowel into the fresh concrete and gives a plane of set in the place of greatest weakness in a T section. Such practice should not be permitted. It is a common source of peril and enforces the necessity for continuity of installation. A concrete job once begun should be prosecuted vigorously by day and night until finished.

---

*1600 Arch St., Philadelphia, Pa.

It seems hardly necessary to call attention to the premature removal of centers. The vital importance of this feature seems to have been enforced more than any other cause of failure, because it invariably reveals a multitude of errors. If there is anything wrong with either the design or installation, a premature removal of centers is bound to bring it to light. Yet in spite of the widespread lesson of this cause of failures, I dare say there will be offenses again next season. And we shall continue to have trouble on this score until some scientific method is enforced of knowing just when the concrete in any section is of sufficient strength to bear its own weight and whatever superimposed weight may be brought to bear by the work of installation.

The French law requires test blocks and sample beams for every section cast, and thus engineers know positively at all times the exact condition of the concrete. The proper time for striking centers then becomes a scientific certainty. So it should be in this country, and will be undoubtedly in course of time.

Finally there is a more or less vital question of the mix—how to secure the proper proportions, the proper consistency, and the proper placing in the molds, and to obtain fair regularity in all these. Far too much work is now proportioned by guess or rule of thumb, so that too little or too much of one or the other ingredient is used. This combined with dirty sand and stone, and fresh or overlimed cement, and reliance on green and indifferent workmen, results in mixes as variable as human nature itself. Some one has said, only too truly, that "the Dago with his shovel is a sword of Damocles over every job of concrete."

The following cautions seem therefore justified to prevent failures and to ensure satisfactory installation:

Design: Look well into details. Proportion a member for its bending moments according to the law, and then investigate carefully the internal strains and negative bending moments, providing steel to assume all tensile stresses, relying on the concrete solely for compression and direct shear. See that the depth of members is sufficient under loads. A common rule for slab depths is three-fifths of an inch per foot of span, and for beams a minimum total depth in inches equal to the span in feet. These rules give both stiff and economical sections. Test the compressive area, the packing of the bars and the fireproofing; provide for the maintenance of all bars in designated position in molds while yet permitting ready placing of the concrete; see that the length of rod is sufficient to develop the section, and if plain bars be used that the ends be provided with hooks as an additional precaution. In many cases, particularly end spans and where steel cores in columns prevent the bars passing into the adjacent span, washers should be provided on the ends of rods of sufficient bearing area to develop the rod. If vibratory loads or repeated loadings and unloadings are expected, adhesion should never be relied on, and washers and hooks provided in all cases.

Installation: In addition to the points already emphasized, all materials should be carefully tested and the proportions of ingredients varied to suit the case. The cement should be stored in water-tight, well ventilated sheds, and stone and sand stored in suitable bins to prevent the admixture of dirt. In the mixing, the preponderance of the fallible human element should be diminished by the universal adoption of machine mixers that automatically and unfailingly mingle the proper amount of ingredients. The necessity for cleaning the molds and flushing same immediately before placing the concrete has already been emphasized.

Every piece of the steel reinforcement should be in its proper position and provision made for maintaining this position during the sequence of operations. A stirrup crimped at the bottom to form pockets for the rods and bent over at the top to provide support on the edge of the beam box is an excellent way of keeping the bars at proper depth and spacing in beams and girders. In slabs little metal chain locks or spring-wire spacers, which also support the rods at the proper depth, are recommended. With these measures taken and every section carefully checked by a competent inspector, who not only can translate blue prints, but knows why every bar goes where it is shown, and who will detect the possible omission of a reinforcing member, the construction is reasonably safeguarded. Then the concreting may proceed, and, as stated before, should proceed continuously in any one section until completed. The concrete should be so wet as to run easily around and under the steel and to require only such tamping as necessary to permit any bridging over of the aggregate, to set free any imprisoned air, and to give a smooth face to the concrete. For this purpose a long, slender steel bladed tamp is recommended, which chops up and settles the fluid mixture very effectively, with little labor.

The freshly placed concrete should be protected from the sun until well set up and kept wet down for a period of several days, generally a week sufficing. Laborers should remain off the fresh concrete for at least a day in warm weather and better for two days.

A daily record should be kept of every section of concrete poured, and, as is done abroad, test pieces should be molded to correspond with each section. Accurate knowledge could then be had at any and all times as to the exact condition of the concrete and the centers removed at exactly the proper time.

Finally, as to supervision, it is highly important that the supervision of reinforced concrete work be entrusted only to skilled experts, and preferably graduate engineers. Men who have gained their experience in direction of work in other construction are in general poorly adapted to this work, as they seem unable to grasp the significance and vital importance of many of the details of the construction. Foremen inured in ways of placing heavy masses of concrete, like foundations and retaining walls, are the worst of all, for they are all-wise as a rule and can not or will not see the great difference between the two applications. A skilled engineer should be on the job to see that the steel is placed correctly and to check the placement before any concreting. With expert supervision, skilled labor is unnecessary, notwithstanding the agitation among the building craft.

These recommendations may seem severe, but if failures are to be prevented and this construction given a fair chance to demonstrate its peculiar merits, they seem entirely justified. Concrete-steel design and construction must be reduced to a science if permanent success is to be had.

Cement Products Exhibition.

Preparations for the Cement Products Exhibition to be held in Chicago, Ill., on Dec. 17-21, are making satisfactory progress. The scope of the exhibition may be judged from the following statement of the various divisions of exhibits: Cement, concrete mixers, block machines, brick machines, cement pipe machines, cement tile machines, cement post machines, cement coloring mixtures, reinforcing metal, cement publications, testing machinery, sheet piling, aggregates, sand, technical institutions, etc.

Details of the arrangement of exhibition space and conditions governing the making of exhibits may be had of Mr. L. L. Fest, Cement Products Exhibition Co., New Southern Hotel, Chicago, Ill.

Gold to the value of $94,373,800 was produced in the United States during 1906.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Methods and Cost of Making Two Hydraulic Fill Dams.

Although several articles have appeared on the power dams described in this article, yet we are enabled to give some valuable data and information on the building of the earthwork of these dams, that has not before appeared in print. Mr. Wm. G. Fargo, Civil Engineer of Jackson, Mich., has furnished us with description, photographs and cost data here given.

The interesting features of the work was hydraulic sluicing during freezing weather, and building hydraulic fills in the beds of rivers. For other articles on this subject the reader is referred to Engineering-Contracting Oct. 9, 1907, page 211, and September 4, 1907, page 144.

The Croton dam is located on the Muskegon River, Michigan, a few hundred feet below the junction of the Big and Little Muskegon Rivers. The Muskegon River is the longest in the state. It is not subject to excessive floods. The entire water shed is a stiff clay with a stratum of sand and gravel 10 ft. in thickness. The surface is mostly covered with a growth of scrub pines and oak. The dam was built to generate electric power for the Grand Rapids-Muskegon Power Co. It has a head of 40 ft. and develops 14,400 H. P.

The essential feature of this dam is the use of sufficient flood gates of such capacity and so arranged that the water is kept at a constant level throughout the year. This is done by means of Tainter gates built of steel, 20 ft. wide and 12 or 13 ft. high. These gates discharge into a tumble bay, from which the water spills over a low concrete weir into the waste channel. The eight Tainter gates are hoisted by means of a worm gear and an electrically operated hoisting crab, with two drums on one shaft. This crab travels on a track of 24 in. gage, so that it can be placed over any of the gates. There is also a handwheel on the crab, in case the motor should not be available.

These gates are set in concrete. This work was built upon a low flat adjoining the power house and penstocks, which latter encroached slightly upon the river, but permitted of constructing the entire plant without interfering with the passage of the river. After the completion of the concrete the river was turned from its course by the use of cribs, and diverted through temporary openings beneath the Tainter gates, while the embankment section, 200 ft. long, was placed across the original channel of the river. This embankment was put in place by a hydraulic sluicing plant. It contains a total of 104,000 cu. yds. of sand and gravel.

There is a line of steel sheet piling at the up-stream side of the concrete work extending entirely across the river valley, and a core wall in the embankment resting upon this line of steel sheet piling. For methods and costs of driving sheet piles of this description on the Muskegon river see Engineering-Contracting, May 1, 1907, page 193. The core wall is 12 ft. in thickness and heavily reinforced. It is located at the line where the surface of the pond intersects the embankment and projects 2 ft. to serve as a wave protection.

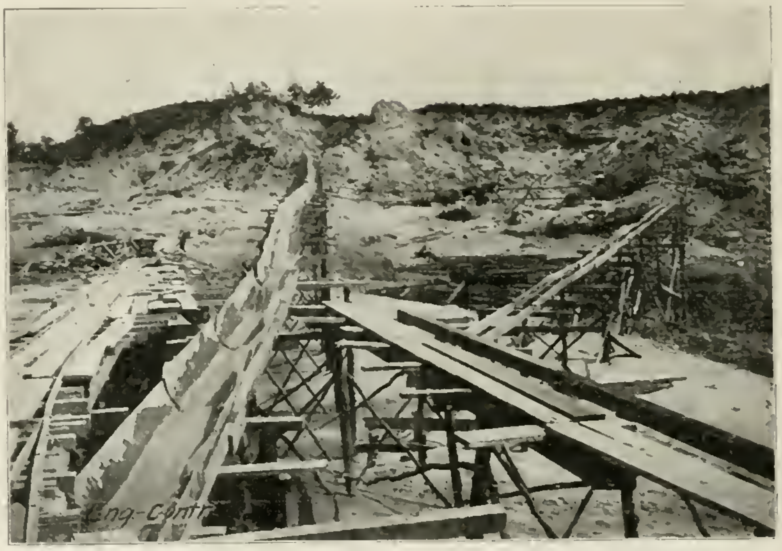

Fig. 1—View Showing Galvanized Iron Troughs and Trestlework for Sluices for the Hydraulic Fill.

The valley at the dam site is about 600 ft. wide, with a bluff on the righthand side a little over 40 ft. high, and a bluff on the left 120 ft. above the water. This high bluff of sand, directly adjacent to the fill, made an ideal condition for sluicing purposes.

The total length of the embankment sluiced into place was 250 ft., with a height of 55 ft. The total width at the top was 20 ft.

Power for pumping was obtained from the Big Rapids dam, 18 miles distant. A 6,600 volt line was taken off the primary and carried on temporary brackets placed on the poles of the 72,000 volt line, which passes the site of the Croton dam. Water cooled transformers stepped this voltage down to 440.

The pumps used for the work were neither the most efficient nor desirable, but inasmuch as they were on hand and could be readily adapted for use on the motor equipment available, they were installed. The pumps suffered frequent break-downs. The plant consisted of two Rumsey 6-in. pumps; two 6-in., one 5-in., and two 3-in. Gould pumps, all of them of the rotary type, belted to motors. The rotary pumps did not operate well with a suction longer than 8 to 10 ft. The four pumps were set in line close together in a shed 20 x 24 ft., projecting over the water, so that the pump suctions could be dropped down direct below the pumps. The motors were placed on the land side of the building. The four pumps were connected with a 10-in. header.

The 6-in. pumps run at a speed of 200 to 250 r. p. m., give a pressure at the pump of 100 lbs., and a discharge of 1,125 gallons per minute. Assuming the efficiency of the pumps at 50 per cent, 140 h. p. is required to obtain this capacity and pressure. Mr. Fargo states that while rotary pumps give good satisfaction for intermittent service of short duration, as for fire purposes, they are not adapted for the continuous hard service on a sluicing plant, and out of the 7 pumps on hand fully one-half were out of order and undergoing repairs the greater part of the time.

During the early stages of the work one of the smaller pumps was mounted on a scow and had the pressure pipe on land connected with a swining joint, so that the scow could rise as the pond filled.

The 10-in. pipe line was spiral riveted. Gate valves were located in the pipe between each pump connection, and one beyond the last pump. The force main was 1,000 ft. long, being successively reduced to 8-in. and 6-in. by wrought pipe with screw connections. At convenient intervals, tees with 4-in. outlets and gate valves were placed along the pipe to allow water to be taken out by hose and lateral pipe lines. The sluicing was commenced at the far end of the pipe line, the first closure of the river being effected there and the bluff was lower at that point than at any other. This allowed the length of the force main to be reduced as the work progressed.

As stated, the principal fill had 104,000 cu. yds. of sand and gravel. The bluff from which the material was taken adjoined the end of the embankment and stood up 75 ft. in height above the top of the bank. On account of the grades required for the troughs the actual face against which the nozzles worked did not exceed 40 ft., in most instances being but 30. The greatest distance material was moved in troughs was 800 ft. The grades were generally 8 and 9%, but on some of the longer troughs the grade was reduced to 5 and 6% towards their ends. With grades less than 6 or 7% there was always trouble caused by stoppages in the troughs, requiring one man to about every 50 ft. of trough to prevent such stoppage. The yellow sand, common to all the pine country of northern Michigan, will readily run on itself at about 10 or 12% grade, that is, when forced along by the action of water running down the slope. Where the base of the excavation was clay or hardpan, no special headworks were necessary to direct the water to the troughs, but in sand and gravelly soil it was necessary to have a converging box, or series of boards set in V form, to start the water into the troughs.

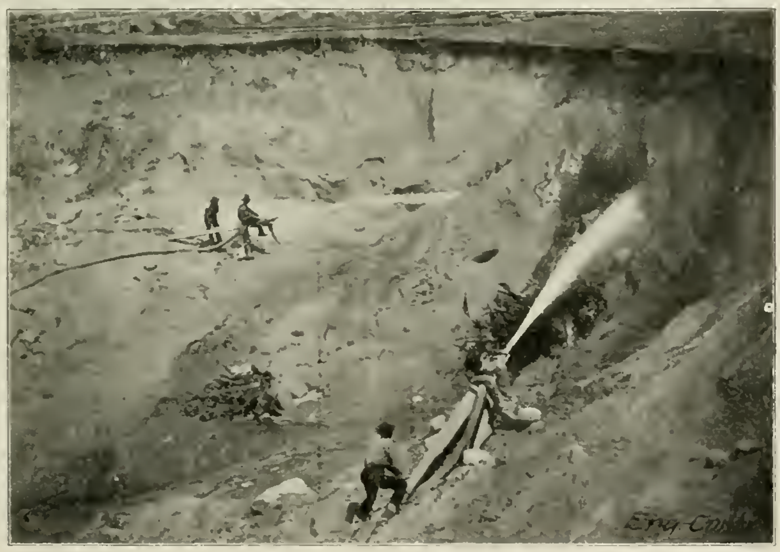
Fig. 2—Arrangement of Nozzles—Hydraulic Excavation in Progress.

The troughs, see Fig. 1, were made of No. 12 galvanized black iron, in 30-in. semi-circular sections, 10 ft. long. These troughs, bent to shape, cost 2¼ cts. per lb., making a cost of 49½ cts. per lineal foot. Each section weighed about 180 lbs. The trough did not leak or have to be calked at the joints on grades of 6 or 8% and over, although the sections were only lapped as shown in Fig. 1. Some wooden troughs made of second-hand lumber were used, but were rapidly cut out by the grinding action of the gravel and sand in the water. In all, 890 ft. of metal troughing was erected and, after four months' constant use on two jobs, they showed but little wear.

The nozzles used were mostly for 4-in. hose, tapering in 24-ins. to an opening of 1¼ or 1½ ins. The taper was uniform and the nozzle end machined and polished smooth for about 2 ins. from the tip inside. Each nozzle was clamped to a 2 x 10-in. plank, about 12 ft. long, and this plank pivoted to a standard similar to the jack used by a wagon wheel painter, only heavier. (See Fig. 2.) This simple device served the purpose of the more heavily constructed monitor or giant, used for high pressure and larger size pipes and nozzles. With this arrangement one man handled each nozzle and was assigned one helper for moving hose and keeping troughs in shape near the nozzle. Where the grades are sufficient no other men were required in the pit except the two men mentioned for each line of hose. With such an outfit and a pressure at the nozzle of 60 to 80 lbs., it is not possible to handle any material more compact than sand and gravel. With a larger nozzle opening and pressure of 150 lbs., at the nozzle, hard clay and loose shale rock may be readily handled. The pressure used was 75 to 90 lbs.

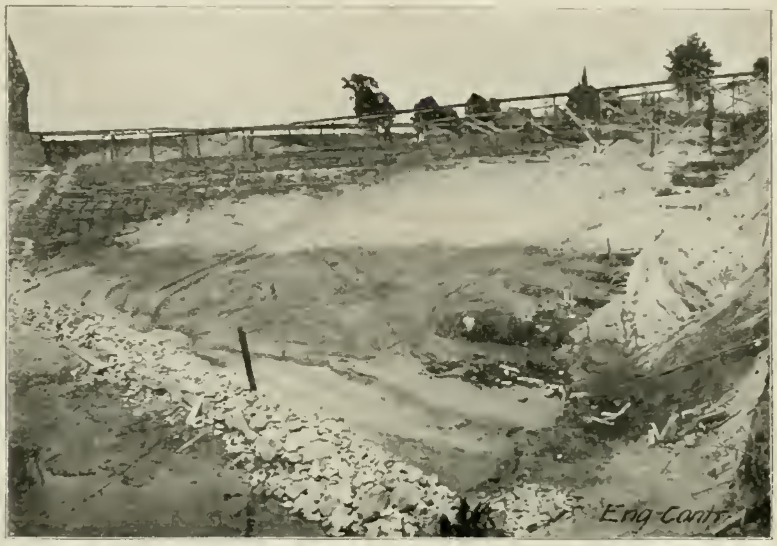

Fig. 3—Face of Hydraulic Fill, Showing Brush and Pole Crib Work for Retaining Flow.

In the two jobs described in this article the base of the work was a hard and pure clay, in which the movement of the water would cut a slight channel; which did not seem to deepen materially by continual use. The slippery clay, therefore, formed an excellent channel for sluicing purposes.

As the material is deposited at the end of the trough line it tends to form a cone, with a slope depending upon the kind of material. The slopes of this cone when made up of sand and gravel seem to drain themselves immediately, so that it is possible to walk dry shod over the material while it is being deposited. In order to compact the material further in the process of deposition, two lines of troughs were used, so as to keep the center of the fill low.

This allowed a pool of water to collect in the center, compacting the material better. Sometimes a temporary dam was thrown up to hold the water on the embankment. The water drained off mostly through the brush and stones on the sides, although arrangements were made to drain off the water at the far end of the embankment. The grade of the flumes used were mostly 8 and 9%, this grade keeping them clean of sand and gravel.

The slopes of the finished embankment at 2:1 or 3:1, were made by setting up boards and using straw to prevent the water undermining the boards, the straw and boards being moved along up the slopes as the work progressed. Toward the end of the fill, where the water passing away was more concentrated, it was necessary to use brush and crib work of small poles, 2 or 3 ins. in diameter, to retain the soft material at the proper slopes. The boards and pole cribs are shown in Fig. 3.

A feature of especial interest in the sluicing work was the depositing of the sluiced material in the river bed. In doing this the river was allowed to run in its original course at one side of the work, the stream being narrowed by cribs behind which material was placed from the troughs. The final closure of the intervening opening was effected with one or more cribs swung to position and filled with stone. The sluicing plant was then set at work and a low fill of long slope under water was made on the up-stream side of the crib. The sluicing troughs were then diverted to the down stream side of the crib and the permanent embankment put in place, the river in the meantime being turned through a temporary opening left through the masonry of the dam.

It was found that the temporary closing cribs, when faced with a sluiced fill on the down-stream side, were almost entirely tight under a head of 15 ft. of water. The water that seeped through and accumulated between the temporary and permanent embankments was cared for by a 4-in. centrifugal pump, run about a quarter of the time. This illustrates the possibility of making impervious embankments when materials are deposited in water.

This work was done from June 25 to Sept. 3, 1907. The wages paid were as follows:

General foreman, per month	$125.00
Asst. forefen, per month	100.00
Foremen, per month	$60 to 75.00
Laborers (average), 10 hrs	1.80
Carpenters (average) 10 hrs	3.00
Blacksmith, 10 hrs	3.00

The laborers were Italians and in addition to the wages paid them, railroad fare from Detroit and return was furnished them, likewise quarters without cost to them. Bread and other supplies were hauled for them free of cost.

The trestles to carry the flumes were built of poles cut on the job and second-hand lumber worth from $8 to $12 per M. The carpenters erected them.

The plant used was as follows:

Two 6-in. Rumsey rotary fire pumps (new)	$ 840.00
Two 6-in. Gould rotary fire pumps (second hand)	750.00
430 lin. ft. 10-in., 16-gage spiral riveted pipe, cost 60 cts., (second hand), 45 cts	193.50
400 lin. ft. 8-in. wrought pipe and fittings (new)	436.45
414 lin. ft. 6-in. wrought pipe and fittings (new); 120 lin. ft. 4-in. wrought pipe and fittings (new)	272.00
Material bought second hand, including all fittings for 10-in. line, also 6-in., 8 in. and 10-in. fittings for pumps, 150 ft. 4-in. rubber hose and nozzles, 350 ft. of 30-in., 12-gage troughing used 2 months elsewhere	800.00
500 ft. 12-gage, 30-in. trough	250.00
Pulley, belting, cotton hose and other supplies	200.00
Total	$3,741.95

The nozzles cost, when made of iron, $4.50 each, while brass 4-in. nozzles cost $12 each. Exclusive of power plant, the outfit on the job was worth $3,741.95. Charging half of it to this job would mean a plant charge of $1,870.98, which is excessive. It would be ample to charge only 25% for interest and depreciation of plant. The plant charge, divided by the total yardage of 104,000 gives a charge per cu. yd. for plant of 1.8 cts.

The electrical power for operating the plant furnished by the power company building the dam was measured by meter 18 miles from the dam. During the time of sluicing 138,008 k. w. hrs. were measured at the meter, but Mr. Fargo deducts 46,008 k. w. hrs. for time and transformer losses and for power used for other purposes, leaving 92,000 k. w. hrs. to be charged to sluicing. The electric power is developed by water and is sold under contract to large consumers for 1 ct. per k. w. hr. At this price the cost for power per cubic yard of earth sluiced was nearly 0.9 ct. The labor costs were:

Labor pay roll	$3,774.61
Teams, removing stumps and stone and handling lumber	248.56
Straw	18.00
Oil, waste, pump repairs, etc	118.83
	$4,160.00

This gives a cost per cu. yd. for all items as follows:

Cost of plant (an excessive allowance)	$0.0180
Labor	0.0370
Teams	0.0020
Straw, oil, waste, etc	0.0010
Power	0.0088
Motor rental	0.0012
Total	$0.068

To this should be added ½ ct. for superintendence.

The costs are all reasonable, but if steam instead of electric power had been used to run the pumps the cost for power would probably have been between 2 and 3 cts. per cubic yard.

The Lyons dam was built in the Grand River valley for the Commonwealth Power Co. The center of the dam was built of concrete and steel, but at each end is a short earth embankment. The valley is in a clay country, consequently the floods are severe. On the opposite side of the river from the power house and between the penstocks and the high clay bluff, which forms the river bank, an embankment 150 ft. long containing 23,000 cu. yds. was sluiced into place.

This work was done in December, 1906, and January, 1907, during the winter months. This undertaking was contemplated with much anxiety. Suitable material could not be obtained, except by sluicing, unless hauled a long way and, as the outfit was on hand, it was set up and work started the latter part of November.

The first work to be done was the closing of the river by sluicing into the pool above the cutoff crib. The right bank of the river was a clay bluff, about 70 ft high, capped with about 10 ft. of sand and gravel. The clay was so tough and compact as to be very expensive for handling by ordinary means, and the fill was made almost entirely from the sand and gravel.

On account of the bluff not having a steep slope, several expensive trestles were necessary to carry the troughs. These and the trouble from ice made the cost of the fill much above the usual cost of such work, when more favorably situated and made in warmer weather. When the temperature approached zero the sluicing plant was stopped, and when it was again started it became necessary to blast the face of the bluff, which had become saturated with water and frozen several feet deep. Even at the cost shown below it is doubtful if any other method of moving earth under the unfavorable weather conditions would have been less expensive. The sluicing plant was a valuable aid in making a quick fill in the closing of the river, also in raising the coffer dams at times of flood during the two months when the sluicing plant was in intermittent operation.

The wages paid on this job were the same as at the Croton dam. The sluicing plant was run 45 days of 24 hrs. each. from Dec. 5 to Feb. 20. The plant had an estimated value of $3,000, and Mr. Fargo deducted from this $1,800 as salvage, leaving a charge of $1,200 for interest and depreciation, which is more than $25 per day, which is a very high allowance. At this rate the plant charge was 5.1 cts. per cu. yd. of earth moved. The labor cost was:

Installation of plant	$ 531.58
Labor running plant	1,063.80
Sluicing labor, building trestle and troughs	3,117.50
Total labor	$4,712.88
675 tons of coal at $2.50	$1,687.50
Total	$6,400.38

The cost per cubic yard was:

Plant	$0.0513
Installing plant	0.0231
Labor running plant	0.0454
Sluicing labor	0.1352
Coal	0.0751
Total	$0.3301

To this cost should be added 3 cts. per cu. yd. for superintendence.

The construction plant was run by electricity, generated on the ground by a 200-h. p. steam plant, the coal for which was hauled 3 miles by teams. The electric line was a 500-volt direct current one.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Engineers' Contracts and Specifications from a Contractor's Point of View.*

BY JAMES W. ROLLINS, JR.†

(Discussion continued from Nov. 6 issue.)

Mr. Frederic P. Stearns: The paper of Mr. Rollins and its discussion at the meeting by other contractors were interesting, and will, no doubt, lead engineers to improve to some extent their forms of contract and specifications and to act in a less arbitrary manner in directing contract work. Probably all engineers of experience have known of many instances where engineers, generally the younger members of the profession, have given arbitrary decisions which have added much to the cost of the contractor's work without materially improving the quality of the work under their charge, or they have modified plans in a manner to save money for their client, regardless of the extra cost to the contractor of such modifications.

As far as practicable there should be cooperation between the engineers who direct works and the contractors who execute them, to produce the required result at the smallest practicable cost. This is obviously for the benefit of both parties, because if an engineer unnecessarily increases the cost of a work, subsequent work let under his direction is likely to go at a higher price, and it certainly is a loss to the contractor if he cannot do the work at the lowest practicable cost.

In the writer's dealings with contractors in the past ten years there were very few who were not willing to do good work or who attempted to be dishonest in their dealings. When there has been trouble it has been, as a rule, with those who furnished supplies to the contractors.

There are several points which Mr. Rollins and others have made with regard to contracts with which the writer fully agrees. For instance, the contractor should not be held responsible for the stability of work designed by others provided the work is constructed as required by the specifications. There are, of course, exceptions to this rule, as it may be entirely proper to require an engine builder or a bridge company or other contractor with a large fund of technical knowledge to be responsible for the efficiency of a machine or other structure.

The writer had supposed that a court would not find a contractor for public works responsible for the stability of a structure made according to the engineer's designs without some specific agreement to that effect, until he was connected with a case where a masonry dam failed in Alabama. In this case the dam failed in his opinion, because its design was such that even if well built it would not resist the pressure of water at the height to which it rose in the river during a flood. The judge in this case ruled that the contractor would not have been responsible for the design of the dam had it not been that he had agreed in his contract "to complete the work and the whole thereof," and that it was not wholly completed. The dam was at the time completed in every part which affected its stability, so that the ruling of the judge was practically to the effect that the contractor guaranteed the design of the dam until its completion.

Such a decision, while it may be legal, is not equitable, as the average contractor cannot be expected to have the knowledge required for the designing of such dams, and engineers should endeavor to have eliminated from their contracts clauses which may result in such an inequitable decision.

There are many features of Mr. Rollins' paper with which the writer cannot agree after viewing them as nearly as he can in an unprejudiced way and from the standpoint of public policy. For instance, objection is made, to clauses in contracts which in any way give the engineer control over the methods to be used to do the work.

The writer has often found it advisable in tunnel contracts to provide for adequate timbering, safety appliances in connection with shafts and cages and ventilation. This control has been found necessary in the interests of the health and safety of the workmen, because many contractors are willing to take risks which ought not to be taken.

As it is advisable not to have divided responsibility, the contractor is made responsible for the safety of the timbering, and the engineer's control is limited by the provision that he may require stronger timbering if, in his opinion, that proposed by the contractor has not sufficient strength.

It is also well that the engineer should have control of the time of removing centers from arches, as there is often a tendency on the part of a contractor who requires the centers for use in another place to remove them too soon, with material detriment to the quality of the work, and, although the contractor is supposed to be responsible for the work, it is not feasible in practice to condemn completed work unless it is positively bad.

As a rule, the writer believes that the contractor should be left free to plan temporary works, but there should be exceptions to this rule when the works are so extensive that they require technical skill for their design and where the failure of the temporary works would lead to great delay and loss.

Practical experience shows that it is not wise, especially where work must be done within a given time, to permit a contractor to take great risks, like that of the breaking of a cofferdam, because it inevitably results in delay and almost as inevitably in a suit on the part of the contractor.

Especial objection is made in the paper to the clause in a contract "which makes the chief engineer the sole judge of everything," and arbitration by two persons, with a third one to be chosen in case they cannot agree, is suggested as an alternative. It must appeal to engineers and others that it is difficult, if not impossible, for an engineer who prepares plans, writes specifications and is interested in the construction of work at a low cost, to be entirely unbiased in his judgment. He is likely to lean either in the direction of his employer, or, recognizing his somewhat anomalous position, to lean toward the side of the contractor.

The suggestion of arbitration is always attractive, as one can picture two entirely disinterested intelligent persons of judicial temperament, who will listen to what is told them by the contractor and engineer and then proceed to investigate for themselves and reach an entirely fair conclusion: but experience shows that this is an ideal and not a practical condition in most cases.

Strong objection is made in the paper to told them by the contractor and the engineer, and then proceed to investigate for the use of the words "except as otherwise directed." This provision, together with the usual provision that "the engineer may make alterations in the line, grade, plan, form, dimensions or materials of the work," may seem very arbitrary, but the writer has always assumed that it would not be feasible or even legal for the engineer to make radical changes under the authority given by these provisions and minor changes must be provided for.

It is suggested in the paper that "the contract must be explicit in all its terms"; also that "the engineer should know what he wants when he writes his specification." The writer has yet to know the engineer who, in connection with important work, is able to tell at the time he writes his specifications just what he wants in all details. He may know what he would like if the conditions prove to be as he expects and yet is likely to learn during the progress of the work, especially where much of it is underground or under water, that the conditions are not what he expected and that there must be some modifications of the views which he held when he wrote the specifications. He should, in writing the specifications, state in them as explicitly as possible what is to be done, but for the benefit of his client and of the contractor there should be such provisions as those above mentioned permitting the engineer to modify the work in view of the further information obtained during its progress.

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*Abstract of paper read before the Boston Society of Civil Engineers, published in Journal Association of Engineering Society. Our abstract is about one-fourth of original paper and discussion.

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Mr. John L. Howard: In this paper the author has presented the contractor's side of contract work in a very able and comprehensive manner, and doubtless it will do engineers no harm to occasionally "see themselves as others see them."

The author claims upon the ground of mutuality in a contract that it is the duty of the engineer to guarantee the correctness and reliability of all borings taken under his direction prior to the letting of the contract. It seems to the writer that contractors have no basis for making this claim if the borings are made by a firm accustomed to that kind of work, and if the different samples are properly located and labeled, and the contractor is at liberty to examine them for himself any time before his bid is submitted. When this is done, hasn't all been done that any reasonable contractor has a right to expect? In such case the contractor has all the data that the engineer possesses, and in case it develops during the prosecution of the work that the materials passed through are different from those indicated by the borings, isn't that one of the legitimate risks which a contractor expects to assume in undertaking work below the surface of the ground?

Mr. Alfred D. Flinn: Mr. James W. Rollins, Jr.'s, paper is particularly timely and suggestive to the engineers of the Board of Water Supply of the city of New York, who are just preparing the first large contracts for one of the greatest engineering projects of the times.

Burdensome requirements and uncertainties in contracts and specifications increase the cost of work and are, therefore, ultimately borne by the owner, the "party of the first part." In any specific case a part of the cost may fall upon the contractor, but if the contractor is to remain in business he must recoup himself for all his costs and make a living profit besides. Fair contracts and reasonable specifications are to the owner's advantage. It is well to remember that the bid price, if a lump sum, or the amount determined by the preliminary quantities and the unit prices bid, does not always represent the total cost of the work, and sometimes misleads the owner or the public official, because through incompleteness or unfairness of the specifications the work is underestimated by the contractor, and bills for extras and other claims materially increase the first figure. The fairer and more complete the specifications and the information furnished the bidders, the more nearly should the bid price approximate the actual final cost.

Exactness of specifications is desirable so far as feasible, and there is room for much improvement in this line, but the writer believes that steady progress is being made by engineers in this direction. Lack of exactness is caused, as the author suggests, frequently by lack of definite knowledge on the part of the engineer. This is due not infrequently to the fact that an engineer has to cover a wide range of work in the specifications for a large project, and some of the details are relatively so minor that he cannot afford to get exact information in advance. Possibly too much is passed superficially in this way. Lack of suitable standards of excellence seems to be another reason for lack of definiteness in specifications. At times this lack is very hard to supply, especially if the character of the work is different from any which has been performed in the same locality previously.

A contract having been signed, the engineer and contractor should be on friendly terms and work together amicably for the accomplishment of the substantial intent of the specifications. The engineer frequently has power to aid the contractor without in any way being disloyal to his employer or sacrificing the quality of the work. It is only fair to give the contractor the benefit, in such cases, especially if he is in straits through no fault of his own. Engineers and contractors should work together to rid contracts from the unfair and hard clauses introduced largely by timid legal minds, over-anxious for the day of defense in court and totally ignorant of the nature of the work and of the character of the men who "do things" instead of split words.

Experience and observation lead the writer to believe that the engineer should rarely dictate the methods or plant to be used by a contractor. Occasionally this may be very desirable. When an engineer does thus dictate, it would seem only fair for the contractor to be relieved of the share of responsibility which does not rightly belong to him.

Finally, in discussing any such subject as this, one should continually keep in mind the difference between large works and small, between short-time and long-time contracts, between public and private conditions and between advertised lettings and lettings limited by invitation to selected parties.

Mr. J. Parker Snow: I agree with the author of the paper in his objection to the one-sided nature of many specifications and contracts. A large part of the trouble, however, voiced by this paper is due to the inherent evils of competitive bidding.

The altruistic ideal of contract work is for a single competent party to make a price that under expected conditions will repay him his capital with interest and a just profit; the owner to pay for unforeseen difficulties that may arise. This is the man-to-man method of our author. But under the present regime, with king Business in the saddle, and every one, owner, engineer and contractor striving for a place ahead, altruism is hopelessly distanced and conditions are far from ideal.

It used to be said that competition was the life of trade; but competitive bidding between our present-day sharp-lined men of affairs is the death of contracting. In their efforts to cut one another's throats they bleed themselves to death. The struggle naturally leads to combination or bankruptcy. It is warfare between individuals, and this was decreed unfashionable when mankind emerged from the stone age.

Engineers, when writing specifications, will welcome hints from contractors, with a view to clearness and smooth working, and I for one am obliged to the author for bringing out the points set forth in his paper. When civilization shall have advanced so that competitive bidding is history, a part of our present difficulties will have disappeared.

Mr. Leonard C. Wason: In the writer's opinion it is very frequently the fault of the *owner* that unfair articles are inserted in contracts. In some cases he does not pay a full commission and the engineer, therefore, will not go to the expense of finding out and assuming responsibility for the accuracy of borings or other uncertainties encountered. A few engineers throw responsibility for all uncertainties to be encountered upon the contractor to save themselves the trouble of the careful study necessary to determine the exact conditions. Sometimes an owner does not allow an engineer sufficient time to do his work thoroughly, and therefore he is compelled to resort to phraseology of contracts which relieves him of all of his own responsibility and requires the contractor to assume it.

Engineers in the permanent employ of an owner are liable to become biased—it may be unconsciously, but nevertheless certainly —from long continuation in one line of service, and they look and act from the viewpoint of the owner rather than from that of a disinterested referee between the owner and the contractor. Public works departments of cities, states and the United States and the railroads employ a permanent staff, and it is the writer's experience that the contracts and specifications from these sources are subject to criticism most generally, and that there is little criticism to be found with the work emanating from private sources.

It would be a distinct advance if owners as a class could be made to realize that there is *positively nothing* which raises a bid like asking a contractor to assume *uncertainties* which may be encountered, and that the engineer earns his money by eliminating such uncertainties, thereby reducing the cost probably more than his own commission amounts to and perhaps several times over; and secondly, that by eliminating all unfair and unreasonable clauses a much better class of bidders can be obtained; thus good workmanship can be secured and usually at a lower price than can be obtained from the cheaper class of workmen who gamble on the uncertainties. Insufficient time to prepare a careful bid is the next most important item in raising the cost of work.

Mr. James W. Rollins, Jr.: Certain engineers seem called upon to assume all responsibility of *design* of temporary work, and then disclaim responsibility in results. Hasn't the time about come for such men to realize that among the contractors are engineers who know their own business, and who knowing it will be thoroughly able to protect their own interests; or who, if they are not themselves technical men, are good enough business men to get an engineer to figure out for them anything necessary? Why is it necessary to furnish plans of centering, ventilation, etc., of tunnels, which matters, in the judgment of the writer, can best be provided for by the contractors, who make such work a specialty, all done upon the ground of safety to men; and leave out of their plans the handling of explosives? As far as the writer has knowledge, the underground work in the New York subways and tunnels, in the Pennsylvania Railroad work, also the subway work in Boston, has all been done by the contractors—they making their own plans of temporary work and being responsible therefor. In the years of work done by the writer on railroads, where certainly the danger of loss of life is greatest, the railroad engineers do not pretend to say how a contractor shall do his work, in its temporary nature. Any engineer has every right to stop a contractor when he goes wrong; so why entail a lot of ill-feeling, disputes and trouble, and also do a great injustice, by prescribing all details of temporary work, and then holding contractor responsible for it, design and all? *It's not a square deal;* we contractors can stand on our own feet, do what is necessary, and be responsible for it.

Mention is made that never does an engineer know what he wants when the contract is let. How then does he expect the contractor to make an intelligent bid?—for if the engineer doesn't know, the contractor surely doesn't.

One member states that we criticise existing affairs and offer no remedy. We do offer a remedy, and in two words—give us a "square deal."

In 1906 Vermont produced marble valued at $4,576,913; the uses to which this marble was put were as follows: Rough: building, $186,626; monumental, $52,756; other purposes, $4,607; dressed: building, $977,319; monumental, $2,007,777; ornamental, $32,523; interior decoration, $1,097,001; other purposes, $218,304.

Methods of Working Gravel Beds in Central Indiana.

In many places in central and northern Indiana thick deposits of unoxidized gravel suitable for road building occur below the level of ground water, or at such a depth as to be unavailable by ordinary methods of stripping and loading. The annual report for 1905 of Mr. W. S. Blatchley, State Geologist of Indiana, contains a description of the methods employed in central Indiana for securing this gravel. Three machines are used for this purpose: the gravel excavator, the endless chain and the gravel pump. The following descriptions of the three methods are taken from the above report.

The Gravel Excavator.—The equipment necessary for this machine is a steel bucket which will hold one yard of gravel, 500 ft. of 1¼-in. Lockwin cable; one pole, known as a mast, 50 ft. high; 3-drum hoisting engine, with 16 H. P. on either side, and 25 H. P. boiler.

Before this apparatus is set for operation an area of 50 by 200 ft. is carefully tested by driving a 1½-in. pipe. This pipe, which is 10 ft. to 20 ft. long, is driven down in a number of places, and by removing the material from the pipe it is possible to see what is the quality of the gravel. If a depth of 15 ft. or more of gravel is found to underlie this area the mast is set 100 ft. back from the one end of the area and an anchor 100 ft. back of it. Back 25 ft. from the other end a 25-ft. pole is set and an anchor 60 ft. farther. Over the tops of the mast and pole and fastened to the anchors, the cable is stretched. The space intervening between the mast and the area to be excavated is where the material is to be dumped, and that between the pole and this area is where the boiler and engine are set. The bucket is suspended by pulleys to the 1¼-in. cable, and by means of smaller cables and pulleys can be lowered at any point beneath the 1¼-in. cable in the area to be excavated. Upon being lowered to the gravel bed it is dragged in the gravel until filled, when it is lifted by the cable and carried to a place immediately above the dumping area, where it is dumped by means of a trap door. The bucket then returns and the operation is repeated.

In this dipping process all the material of the deposit is taken out, clay and fine sand as well as gravel. For this reason the gravel has to be of a good character before a gravel excavator can be used. The stripping, if more than 4 or 5 ins., is always removed unless the gravel is exceptionally free from clay. The daily capacity of this machine is from 100 to 200 cu. yds., 125 yds. being an average. The cost of lifting a cubic yard ranges from 15 to 25 cts., depending upon the stripping and amount of gravel taken out in one setting.

The Endless Chain.—This machine is composed of a number of little buckets which make up part of the links of the chain. These buckets have a capacity of 125 to 150 cu. ins. They are opened at the top and bottom so that a good circulation of water passes through the material which they contain when they are being dragged over the gravel bed. This circulation washes out a large part of the clay, dirt and fine sand. Besides the chain there must be a 15 to 20 H. P. engine and boiler, and a mast. The length of the chain and the number of buckets are governed in accordance to the length of the pit, more buckets being added or taken out to satisfy the conditions.

Like with the gravel excavator, an area of about 50 by 200 ft. is tested. If there is 9 ft. or more of gravel the chain is fastened to a shaft, which is connected to the engine, at the one end and to a pulley at the top of a mast, which is about 25 ft. high and 60 ft. back from the area to be excavated, at the other. As the filled buckets come up out of the pit and pass over the pulley and the top of the mast the loads are dumped, and they return, repeating the operation. By this process from 50 to 80 cu. yds. are taken out daily at a cost ranging between 15 and 25 cts. each. No stripping has to be done, the dirt being allowed to fall into the pit and wash out through the gravel. Frequently pits that contain entirely too much clay for a gravel excavator can be worked with great success by this apparatus because of the washing out of much of the finer material.

The Gravel Pump.—With the gravel pump pipe tests of the area underlain by gravel are made. If a depth of 6 ft. or more of gravel are found with an extent of 30 by 100 ft. the pump and a 12 or 15 H. P. boiler and engine are set. This apparatus pumps out the gravel, fine sand, clay and water together. The output is from 30 to 50 cu. yds. per day. The gravel pump does not seem to give as good satisfaction as the excavator and endless chain.

Appropriate celebration of the centennial of anthracite coal is being considered by the citizens of the town of Plymouth, Pa. In 1807 the first shipment of the "black stone" was made by boat down the Susquehanna river, from Plymouth to Columbia, Pa. This date marks the beginning of the use of anthracite which, according to records of the U. S. Geological Survey, was discovered about 1790, but was burned only by the use of blowers and forced draught before 1807.

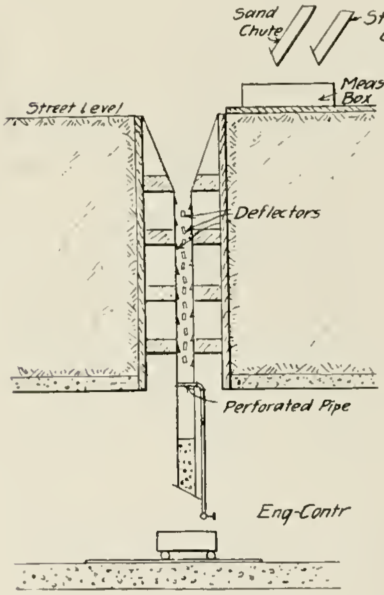
Water has been turned into the new channel of the St. Mary's River at West Neebish, Mich., marking the completion of one of the greatest projects undertaken on the Great Lakes since the building of the Poe Lock. The new channel is more than two miles in length, 9,000 ft. of which is cut through solid rock. It is 300 ft. in width. The project has cost upward of $3,000,000.

Methods and Costs; Some Old; Some New.

Horse Maintenance.—In a report to the Street Cleaning Department of Boston, Mass., Mr. Richard T. Fox, Sanitary expert, Chicago, Ill., gives some figures as to the stable and yard expenses of that department for 1906. The following matter has been taken from that report. The street cleaning department owns 128 horses, which are used for driving purposes for machine sweeping and the removal of street dirt. Of these horses 95 are maintained directly by the department and 33 are boarded by the Sanitary Department. The net cost in 1906 for rent, repairs, shoeing, veterinary services, medicines and feed for the 128 horses amounted to $66,283. The cost per horse per year is therefore $517.83 or $43.15 per month. As a comparison Mr. Fox found that the S. S. Pierce & Co., wholesale grocers of Boston, paid $27.65 per horse per month for maintenance, the cost including shoeing, veterinary service and boarding in a public stable. Mr. Fox considers that $19 per month is a fair average yearly price per horse, if maintained at private expense. The horse shoeing bill for the Street Cleaning Department amounted to $33.43 per year per horse or $2.78 per month. The veterinary services and medicine amounted to $17.97 per horse per year. In comparison with this Mr. Fox found that S. S. Pierce & Co. pay a little less than $12 per year for veterinary service and medicine; the Boston Fire Department pays $12 per year per horse, and the Knickerbocker Ice Co., Chicago, Ill., pays $5 per year per horse.

Gravity Mixer.—The accompanying cut shows a simple "gravity" mixer which was used in mixing the concrete for a tunnel lining. The arrangement was placed in a shaft and consisted of a hopper connected to the top of a vertical 12x20-in. rectangular chute. At intervals of 24 ins. inclined baffle plates made of iron plates and wooden backing blocks were placed in the chute. The baffle plates were staggered on opposite sides, those on two sides of the chute being set at an angle from the vertical and the spaces between them interrupted by through bolts which served to deflect and displace the falling materials. About 16 ft. from the top water was admitted to the chute through two horizontal pipes controlled by a valve in the bottom of the tunnel. The chute was about 30 ft. long and had its lower end closed by a balanced valve. The sand and broken stone were drawn from bins through chutes into the measuring box, which had neither top nor bottom, but rested on a smooth floor. The box was filled and leveled to the required height with broken stone, the required amount of sand was then added, and the cement placed on top. The box frame was then lifted and the mass shoveled into the chute. Batches of about 1 cu. yd. of concrete were mixed in the arrangement.

Tunneling with Telescopic Tubes.—In the construction of a 20x30-in. sewer it became necessary to cross under an old brick aqueduct without disturbing the latter. Accordingly the tunnel was driven with a set of five telescopic tubes, each differing in diameter by 2½ ins. Each tube was 6¼ ft. long and was made of ½-in. steel, the largest tube being 5 1-3 ft. in diameter and the smallest 4½ ft. in diameter. At each side of the aqueduct a shaft was dug, the shaft on the entering side of the tunnel being the largest. The large tube was lowered into this shaft, and a hole cut in the sheeting just large enough to admit it. Then by means of two jack screws acting upon a cross timber placed longitudinally half way between the bottom and center of the tube it was forced into the ground. The material was removed from the tube and another section started, the process being repeated until the shaft on the other side of the aqueduct was reached. When the tubes were all in place, the joints between them were filled with mortar, a small space being left at the top for grouting. The grouting was done by means of a 1-in. pipe, which was carried through the tunnel with branches at each joint leading to the small space. When the sewer was constructed this pipe was built in the masonry.



"Gravity" Mixer.

Cost of Transporting Logs by Driving and by Trains.—Practically one-third of the lumber used for pulp and paper in the state of Maine comes down the Kennebec waters. The annual drive in the main river usually amounts to about 150,000,000 ft. B. M. In Water Supply and Irrigation Paper No. 198, Mr. H. K. Barrows gives some data as to the cost of driving on the above waters, the data being compiled from the reports of the Kennebec Log Driving Co., which controls the drives in the main river, the Moose River Driving Co. and the Dead River Driving Co. These companies drive the logs and apportion the cost as a tax per M. ft., this tax varying with the distance; this tax is the cost per M. ft. for logs driven the distance for which the full tax applies. In the table below the cost of log driving on Kennebec River and tributaries, 1901-1905, is given, the cost per ton mile being approximate and calculated on the basis that 1,000 ft. B. M. weights 3,500 lbs.:

Drive.	Distance—Miles.	Average tax per M.	Cost of driving.	
			Per mile—thousand.	Per ton—mile.
Kennebec River....	91	$0.41	$0.0045	$0.0026
Kennebec River....	24	.12	.0050	.0028
Dead River.......	43	.38	.0089	0051
Moose River..... ..	17	....	.024	.014
Moosehead Lake (Moose River to lake outlet, logs towed by boat)...	9	* .12	.013	.0074

*Contract price for 10 years.

The figures cover, in addition to the cost of driving itself, the other charges arising in carrying on this work, such as costs of dams, improvement of channel, booms, etc., as well as executive charges. Many important changes have been made during the period covered by the above costs and consequently the unit costs are higher than they would have been had a longer series of years been considered. From the above table it appears that the cost of log driving per ton mile varies from about one-fourth to 1½ cts., depending on the distance driven and difficulties experienced. The average freight rate in the United States at present is about 0.8 ct. per ton-mile and for the New England group of railroads 1.20 cts. per ton-mile. Under exceptionally favorable circumstances rates as low as 0.2 ct. per ton-mile have been granted for coal transportation from the coal fields to tide water. For the sake of comparison rates during 1906 for log transportation on the new Somerset Ry. extension are given below:

Logs shipped from Moscow to—	Average distance, miles	Charge per ft. B. M.	Cost of transportation.	
			Per mile—thousand.	Per ton—mile.
Bingham...	12	$1.75	$0 146	$0 080
Solon..	20	2.00	.100	057
North Anson... ..	29	*1.50	052	030

* This price involves reshipment as manufactured lumber on Somerset Railway.

At a public demonstration given Oct. 23, the Marconi wireless telegraph station at Glace Bay, Cape Breton, is said to have sent a message to Clifton, Ireland, and within five minutes received a reply.

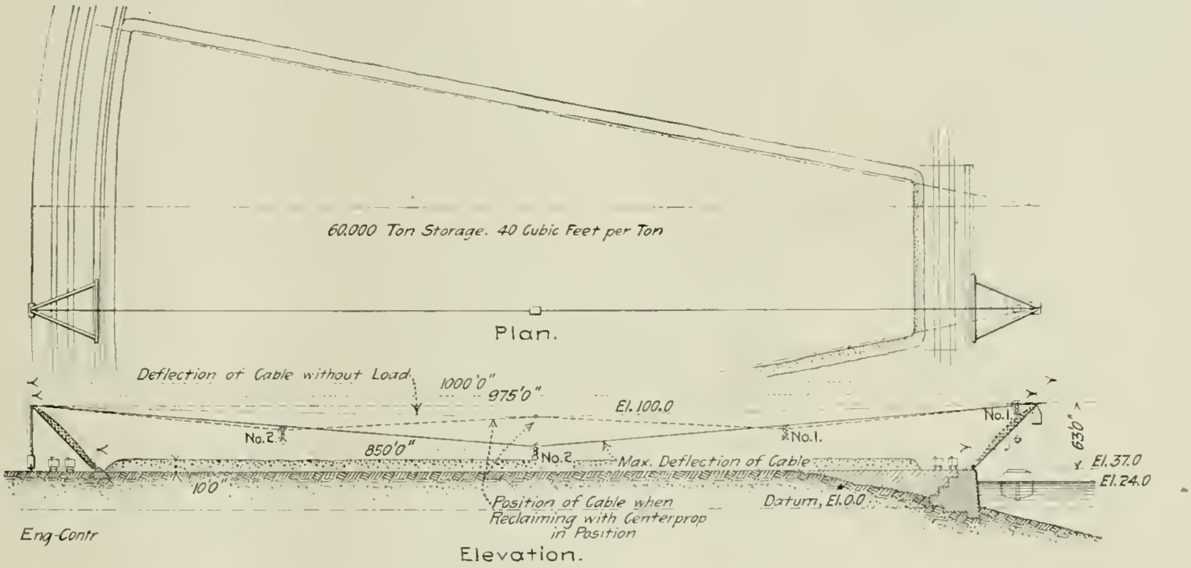
An Ingenious Cableway in Which the Sag in the Cable Is Practically Eliminated by Oscillating Towers, and Its Application to Contract Work, Etc.

In the accompanying drawing we illustrate an electric cableway that merits the careful study of everyone who is interested in transporting earth, sand, rock, coal, etc. This particular drawing shows the general layout of a plant designed to store coal, the coal being removed from boats, but the plant is equally serviceable for canal, or railway, or trench excavation, and for concrete and masonry construction. The feature that merits particular attention is the oscillating tower at each end of the cableway. This inclined tower, or "shears," is A-shaped, having two legs and a heavy counterweight suspended from the apex of the tower. An electric trolley or carriage travels on the cable between the towers, and does all the hoisting and conveying of the material. When the electric trolley is at the center of the cable, the counterweights rise and there is a very decided catenary or sag in the cable; but the moment the trolley begins to move toward either tower, the counterweight begins to lower, thus lifting the trolley and its load. This virtually eliminates the sag of the cable, so that the trolley is not always climbing a steep hill. Indeed, when the trolley reaches either tower, the cable is almost as straight as string stretched between the two towers. By virtue of this action, a light cable and a comparatively small motor on the trolley may be used, and yet secure a large output even with a very long span. No signal men are required, for the operator rides on the trolley, and is always directly over his work.

It is now several years since the first Balanced Cable Crane was installed in this country, and many important plants have been erected abroad, notably at the Keyhaum Davenport docks; at Palmer's works on Jarrow-on-Tyne, where the battleship Lord Nelson was built; and at the Zambesi Falls, Africa, where a span of 870 ft. was necessary to transport bridge materials across the gorge. A number of important installations have been made in this country, among which the most recent is a coal storage plant at Watertown, N. Y., illustrated on our front cover. The Watertown plant, it will be noted, is equipped with electric motors not only on the trolley or carriage, but also on each of the oscillating towers. In this manner each tower can be propelled along the single rail track. It is not necessary that the two towers move simultaneously. Indeed, one tower can travel 25 ft. without moving the other tower. The towers have a traveling speed of 43 ft. per min., when it is desired to shift them.

The electric load carriage, or trolley, handles a 3-cu. yd. Faivrette clamshell bucket, and has a traveling speed of 1,500 ft. per min. and a hoisting speed of 80 ft. per min., with a 60 H. P. motor.

This plant was designed, built and installed by the Balanced Cable Crane Co., 133 William St., New York City.



Cableway in Which Sag in Cable is Practically Done Away With by Oscillating Towers.

Form for Keeping Account of Cars of Materials.

Mr. George R. Humphrey, member of the firm of Joseph Ross Co., bridge builders and general contractors of Boston, Mass., sends us the form shown in accompanying cut. Mr Humphrey has used this form for a number of years to keep account of materials received in carload lots.

The form records the number and initial of the car, time of arrival and delivery and also when the car is released. The material man keeps this record and obtains from the railroad agent the time of arrival. This form is ruled up in a small memorandum book, and on the adjoining page is kept a record of the material received in each car and the amount, such as 15 tons stone, or sand, 12 M. ft. of lumber and other materials.

Mr. Humphrey writes that this record shows at a glance what cars are on demurrage or those about to go on demurrage, thus showing the material man the cars to be unloaded first, when there is more than one car waiting to be unloaded. Bills for materials can also be checked up from this record, and freight bills paid only for cars that have been received.

CEMENT.

Note	Car No.	Init.	Arrived	Delivered	Released
	45913	N Y C	9-5 11 am	9-7 2 pm	9-8 9 am
$1 dm	69149	"	" 3 pm	9-8 11 am	9-13 10 am

Form for Material Account.

Being in book form, previous day records can be quickly looked up, and the records of cars received for each contract can be kept in one book and readily filed when the job is completed.

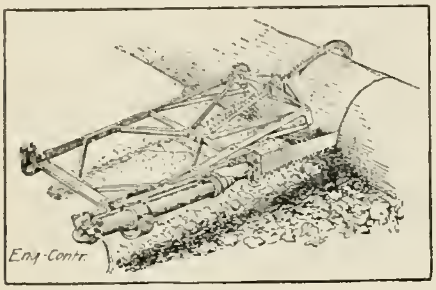
We might add that in addition to the information kept by Mr. Humphrey, a few columns might be added to show cost of unloading cars and hauling material. One of the editors of this journal used a similar form some years ago. Besides showing the record as given here, he had a column for foreman, if one was in charge of unloading, a column for the men, one for the teams, and one to show the approximate length of haul.

This record besides giving a cost of the work done, allowed the contractor to know if the work was done with dispatch and prevented the men from idling away their time, as they are likely to do when a few men are sent off by themselves to do such work. In a column for remarks notation was made if any material or goods were received in bad condition. We will be glad to receive similar forms used by other contractors.

Pneumatic Saw for Logging.

In an issue of the Scientific American a description and cut of a saw actuated by compressed air is given, the saw being in use in the timber lands of California.

After the trees are felled, and the limbs and brush cleaned away, the pneumatic saw is attached to the log and cuts it into lengths. A traction engine equipped with a compressor and air receiver and allowing the use of the air within a radius of 300 ft. by means of hose, is moved by its own power to the neighborhood of a number of logs. The frame can be attached to a log of any size and the heavy cross-cut saw fastened to the holder of the piston after the frame has been set. Thus, while the saw is at work, other frames can be set ready to receive the saw. It is customary to use three frames for one saw. The saw requires no attention after it begins to cut.



Pneumatic Logging Saw.

The saw is said to effect a saving of time, labor and operating expense. Nine men are needed to operate it, the average daily cost being $25, exclusive of repairs. Contractors may find use for such machine in clearing land, or in sawing large timbers for cribs, trestles, tunnel lining, etc.

The saw is manufactured by the Ashland Iron Works of Ashland, Oregon. The compressor attachment can be fastened to any make of traction engine.

The entertainment committee of the Western Society of Engineers has announced that Mr. John W. Alvord, M. W. S. E., will give an informal talk, with lantern slide illustrations, before the society and its friends, including ladies, at Kimball Hall, 243 Wabash avenue, at 8 o'clock Saturday evening, Nov. 16. The subject will be Camera Engineering Notes from Mexico, and is based on results of a trip in attendance at the convention of the American Society of Civil Engineers, July,

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The value of marble produced in the United States in 1906 amounted to $7,582,938, as compared with $7,129,071 in 1905. Vermont lead in the production, the value of its product being $4,576,913, as compared with $4,410,820 in 1905.

At present there are 1,622 miles of railway under construction in China. The mileage of completed railway is 3,746.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write direct to the advertisers and state that you saw the catalog mentioned in *Engineering-Contracting*. If you are in the market for tools, machinery or supplies tell us and we will notify promptly the leading manufacturers.

No. 0446. **Manganese Steel.** Taylor Iron & Steel Co., High Bridge, N. J.

The large line of manganese steel specialties made by this company includes gears, dredge teeth, heads, mantles, and cones for crushers, stamps, dies, etc. One of the articles recently developed is a two-part tooth for steam shovels. The head is made with a web which fits into a slot in the shank and is fastened to the shank with only two bolts. This tooth is well worth learning about.

No. 0447. **Thor Pneumatic Tools.** Independent Pneumatic Tool Co., Chicago and New York.

This is a catalog of the full line of pneumatic tools and compressed air fittings for pneumatic tool work, made by the above named company. The wide range of work for which pneumatic tools are used now-a-days makes a list of the numerous separate tools given impossible. There are, however, rotary and percussion tools of all kinds shown, with tables of sizes, weights, capacities, and a general description. The catalog is most handsomely printed and illustrated.

No. 0448. **Chain Belts.**—Chain Belt Co., Milwaukee, Wis.

This is a catalog and price list of 287 pages, illustrating and listing the large line of chain belts and elevating and conveying machinery made by the company named above. There are a number of pages of directions and instructions for the installation and care of chain belts, sprocket wheels and gearing, and numerous tables of useful data for the millwright and mechanical engineer. The arrangement of the catalog matter is excellent and the cuts of the various chains are unusually clear and handsome. Several views are given of conveyor and elevator plants using the company's appliances.

No. 0449. **Leadite.**—The Leadite Co., 1215 Filbert St., Philadelphia, Pa.

Leadite is a metal composition weighing about one-sixth as much as lead and used in place of lead for filling pipe joints. The properties of leadite, its cost and the method of using it are fully described in this 24-page pamphlet. The pamphlet is well worth reading.

No. 0450. **Reinforced Concrete Construction.**—Turner Construction Co., Bowling Green Bldg., New York, N. Y.

This pamphlet is well worth having for the descriptions contained in it of reinforced concrete building work. One of the buildings described is an 8-story factory in New York City, another shows some interesting pitch root work, and others are stables, sand hins, elevated railway stations, and farm buildings. The system of construction used by the company is the Ransome. Several tests of floor slabs, including complete details of the standard fire and water test which got the approval of the system from the New York Building Department, are given.

No. 0451. **Filters.**—International Filter Co., Chicago, Ill.

This six-page circular describes and illustrates the mechanical filter made by the company named.

No. 0452. **Reinforced Concrete Ties.**—Percival Cuncrete Steel Tie Co., Galveston, Tex.

This 12-page pamphlet shows several sections of track laid with the concrete steel ties made by the above named company and also describe the tie construction.

No. 0453. **Alundum.**—Norton Co., Worcester, Mass.

Alundum is an abrasive produced by electric smelting of bauxite. This pamphlet describes the method of manufacture, the properties and the use of the material for grinding purposes. It makes nine pages of interesting reading.

Personals.

Messrs. Geo. H. Cushman, James A. Fairleigh, L. B. Lockwood, H. C. Beck and D. W. Hughes have organized the Cushman-Fairleigh Engineering Co., of Chattanooga, Tenn., and will engage in a general engineering business.

Mr. J. P. Hallihan has resigned his position as Chief Engineer of the Rio Grande Sierra Madre & Pacific R. R., and the Sierre Madre & Pacific R. R., and has become connected with the South American Coast Construction Co.

The Engineers' Club of Philadelphia, Pa., now located at 1122 Girard St., that city, has purchased a house at 1317 Spruce St. for $55,000, and after remodeling the interior will use it as a club house. The house is a 4-story brownstone front structure on a lot 25x170 ft.

Mr. Frank D. Heath has been appointed Superintendent of the Construction, Operative and Traffic Departments of the Canon City & Royal Gorge Electric R. R. Co., which proposes to construct an electric railway in Canon City, Colo.

Messrs. E. Stanley Field and Henry M. Lilly have entered into a partnership under the firm name of Field & Lilly and have opened offices in the Garrell Bldg., Wilmington, N. C., where they will engage in practice as architects and engineers.

Mr. F. B. Freeman, heretofore Designing Engineer of the New York Central & Hudson River R. R., with headquarters at New York City, has been appointed Engineer of Construction in charge of contract work in the exterior zone of the above railroad

Messrs. Minard L. Holman, Charles L. Harrison, Allen Hazen, F. P. Stearns and John R. Freeman have been selected as a board of appraisal to determine the value of the plant of the Denver Union Water Co., which the city of Denver, Colo., proposes to purchase.

Mr. Frederick L. Ford, City Engineer of Hartford, Conn., and Vice-President of the American Civic Associations Department of City Making, delivered several addresses this week before various organizations and clubs of Chicago, Ill., in behalf of the project for the establishment of public comfort stations.

William R. Kellogg, one of the oldest civil engineers in Chicago, Ill., died Nov. 4, at the Oak Park Hospital, after an illness of two weeks. Mr. Kellogg was born in Hampton, N. Y., and came to Chicago 35 years ago. He was chief engineer in charge of building the Chicago & Alton extension to Kansas City.

Mr. Albert T. Perkins, railroad expert of the Municipal Bridge and Terminals Commission, of St. Louis, Mo., has been engaged by the Royal Canadian Railway Commission to co-operate with its engineers in establishing an elaborate terminal system at Toronto, Ont. Mr. Perkins has been granted a temporary leave of absence by the first named commission to perform the work desired of him by the Government Board of the Dominion.

Eldredge Bently Manning, an old time contractor of Chicago, Ill., died Nov. 6, of pneumonia at the home of his daughter in Austin, Ill., aged 91 years. Mr. Bently came to Chicago in 1854 and soon thereafter entered the contracting business. He built the iron front building at Lake and Dearborn Sts. for Isaac Burch, said to be the first iron front building erected in Chicago. He also built the gas works on the South Side for the Peoples Gas Light & Coke Co.

Charles A. Perkins, formerly President of the Chicago, Burlington & Quincy R. R., died Nov. 8 at his home in Westwood, a suburb of Boston, Mass. Mr. Perkins was elected President of the C., B. & Q. R. R. in 1881. At that time the Burlington system was controlled by New England men, and Mr. Perkins removed to Boston, where the principal offices of the company were located. He continued in office until 1901, when he resigned on account of the passing of the control of the road to New York interests.

Mr. S. T. DeLaMater, Engineer, formerly with the Standard Construction Co. of Chicago, has been engaged by the General Fireproofing Co., and for the present is located at the home office in Youngstown, O. Mr. DeLaMater was graduated from Cornell University in 1900, and through his connection with a large number of contracting firms has acquired a wide experience in reinforced concrete design and construction. Among the companies with whom he has been connected are the Osborne Engineering Co., Cleveland, O.; Paul F. P. Mueller, Falkenau Construction Co., Standard Construction Co., Chicago, and L. P. & J. A. Smith Co., of Cleveland.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED

Bridges.

Nov. 14. West Chester, Pa. ....Nov. 13
Nov. 14. Jasper, Ind. ....Nov. 13
Nov. 15. Portland, Ore. ....Oct. 23
Nov. 15. Cincinnati, O. ....Oct. 30
Nov. 15. Cincinnati, O ....Nov. 6
Nov. 15. Uniontown, Pa. ....Nov. 13
Nov. 16. Sidney, O. ....Nov. 13
Nov. 18. New Castle, Ind...........Nov. 13
Nov. 20. Georgetown, S. C..........Oct. 30
Nov. 20. Graham, Tex. ....Nov. 13
Nov. 22. South Bend, Ind...........Nov. 13
Nov. 22. Big Fork, Minn.............Nov. 13
Nov. 23. Fresno, Cal. ....Nov. 13
Nov. 25. Los Angeles, Cal..........Nov. 13
Nov. 29. Cincinnati, O. ....Nov. 13
Nov. 29. Portland, Ore. ....Nov. 6
Nov. 29. Bethlehem, Pa. ....Nov. 6
Feb. 13. St. Charles, Mo............Oct. 30

Buildings.

Nov. 13. Central Islip, N. Y........Nov. 6
Nov. 14. Pine Grove, Pa.............Oct. 30
Nov. 14. Jersey City, N. J..........Nov. 6
Nov. 14. Jersey City, N. J..........Nov. 6
Nov. 14. Denver, Colo. ....Nov. 6
Nov. 14. Cincinnati, O. ....Nov. 13
Nov. 14. New Haven, Conn..........Nov. 13
Nov. 15. Chippewa Falls, Wis.......Oct. 9
Nov. 15. Fort D. A. Russell, Wyo...Oct. 30
Nov. 15. Superior, Wis. ....Oct. 30
Nov. 15. South Bend, Ind...........Nov. 6
Nov. 16. Washington, D. C.........Nov. 13
Nov. 16. Chicago, Ill. ....Nov. 13
Nov 19. Jefferson Barracks, Mo.....Oct. 30
Nov. 19. Chicago, Ill. ....Nov. 13
Nov. 20. Fort Monroe, Va...........Oct. 30
Nov. 20. Runge, Tex. ....Nov. 13
Nov. 20. New York, N. Y...........Nov. 13
Nov. 20. Phoenix, Ariz. ....Nov. 13
Nov. 21. New Orleans, La..........Oct. 9
Nov. 21. Greenville, Tenn. ....Oct. 23
Nov. 22. Portsmouth, Va. ....Oct. 23
Nov. 25. Tyler, Tex. ....Oct. 23
Nov. 26. Danville, Pa. ....Nov. 13
Nov. 27. Fort Mackenzie, Wyo.....Nov. 6
Nov. 27. Washington, D. C........Nov. 6
Nov. 27. Nashville, Tenn. ....Nov. 13
Nov. 29. Marion, Ind. ....Oct. 30
Nov. 29. New Albany, Ind.........Nov. 6
Nov. 29. Oakmont, Pa. ....Nov. 13
Nov. 29. New Albany, Ind. ....Nov. 13
Dec. 2. Devils Lake, N. Dak......Nov. 6
Dec. 2. North Chicago, Ill.........Nov. 13
Dec. 2. Ely, Nev. ....Nov. 13
Dec. 3. Nevada, Mo. ....Oct. 30
Dec. 3. Tempe, Ariz. ....Nov. 13
Dec. 5. Waldoboro, Me. ....Oct. 30
Dec. 7. Remsen, N. Y..............Nov. 13
Dec. 9. Wernersville, Pa. ....Nov. 6
Dec. 10. Canton, S. Dak............Nov. 13
Dec. 10. Alpine, Tex. ....Nov. 13
Dec. 10. Mobile, Ala. ....Nov. 13
Dec. 10. Jacksonville, Fla. ....Nov. 13
Dec. 17. Detroit, Mich. ....Nov. 6
Dec. 17. Pawnee, Okla. ....Nov. 13
Dec. 19. Ocala, Fla. ....Nov. 13
Dec. 23. Ann Arbor, Mich..........Nov. 6
Dec. 30. Lancaster, Pa. ....Nov. 13
Jan. 2. Flint, Mich. ....Nov. 13

Roads and Streets.

Nov. 13. Brooklyn, N. Y...........Nov. 6
Nov. 13. Madisonville, O. ....Nov. 13
Nov. 14. New York, N. Y..........Nov. 6
Nov. 15. Pensacola, Fla. ....Oct. 23
Nov. 15. Pittsburg, Pa. ....Nov. 6
Nov. 15. Cincinnati, O. ....Nov. 6
Nov. 15. Chillicothe, Mo. ....Nov. 6
Nov. 15. Clarksville, Ark. ....Nov. 13
Nov. 16. Bluffton, Ind. ....Nov. 6
Nov. 16. Norwood, O. ....Nov. 13
Nov. 18. Albany, N. Y...............Oct. 30
Nov. 18. Atlanta, Ga. ....Nov. 6
Nov. 18. Chicago, Ill. ....Nov. 13
Nov. 19. Swatara, Pa. ....Nov. 6
Nov. 19. Harrisburg, Pa. ....Nov. 6
Nov. 19. Lima, O. ....Nov. 13
Nov. 19. St. Louis, Mo. ....Nov. 13
Nov. 20. Harrisburg, Pa. ....Nov. 6
Nov. 20. Des Moines, Ia...........Nov. 6
Nov. 20. Hot Springs, Ark.........Nov. 6
Nov. 20. Brooklyn, N. Y............Nov. 13
Nov. 21. Albany, N. Y...............Oct. 30
Nov. 21. Harrisburg, Pa. ....Nov. 6
Nov. 21. Kansas City, Mo..........Nov. 13
Nov. 22. Harrisburg, Pa. ....Nov. 6
Nov. 23. Fort Myer, Va.............Nov. 13
Nov. 23. Knox, Ind. ....Nov. 13
Nov. 25. Columbia, S. C.............Oct. 30
Nov. 26. Fort Flagler, Wash.......Nov. 6
Nov. 26. Wilmington, Del. ....Nov. 13
Nov. 29. Logansport, Ind. ....Nov. 6
Dec. 2. Lebanon, Ind. ....Nov. 13
Dec. 3. Monticello, Ind. ....Nov. 6
Dec. 6. Salt Lake City, Utah......Oct. 23
Dec. 7. Peru, Ind. ....Nov. 13
Dec. 10. Lebanon, Ind. ....Nov. 13
Dec. 13. Monticello, Ind. ....Oct. 30
Dec. 14. Lebanon, Ind. ....Nov. 13

Sewers.

Nov. 13. Reading, Pa. ....Oct. 30
Nov. 13. Springfield, Ill. ....Nov. 13
Nov. 14. St. Paul, Minn.............Nov. 6
Nov. 14. York, Pa. ....Nov. 13
Nov. 14. Harrisburg, Pa. ....Nov. 13
Nov. 15. Boston, Mass. ....Oct. 30
Nov. 15. Milwaukee, Wis. ....Nov. 13
Nov. 15. Decatur, Ill. ....Nov. 13
Nov. 16. Buffalo, N. Y.............Nov. 13
Nov. 18. St. Paul, Minn.............Nov. 13
Nov. 19. Marion, O. ....Nov. 13
Nov. 20. Springfield, O. ....Nov. 6
Nov. 20. Des Moines, Ia...........Nov. 6
Nov. 20. Oakland, Cal. ....Nov. 6
Nov. 20. Reading, Pa. ....Nov. 13
Nov. 20. Brooklyn, N. Y............Nov. 13
Nov. 20. Richmond, Ind. ....Nov. 13
Nov. 21. Kansas City, Mo..........Nov. 13
Nov. 21. Youngstown, O. ....Nov. 13
Nov. 22. Newport, Pa. ....Nov. 13
Nov. 22. Kendallville, Ind. ....Nov. 13
Nov. 25. Canton, O. ....Nov. 13
Nov. 25. Fort Du Pont, Del.........Nov. 13
Nov. 27. White Plains, N. Y........Nov. 13
Dec. 2. Cadillac, Mich. ....Oct. 23
Dec. 3. Auburn, N. Y..............Oct. 16
Dec. 6. Salt Lake City, Utah.....Nov. 6

Water Supply.

Nov. 14. Fort Mackenzie, Wyo.....Oct. 23
Nov. 14. Grand Forks, N. Dak.....Nov. 6
Nov. 15. Phoenix, Ariz. ....Oct. 2
Nov. 15. Grand Forks, N. Dak.....Nov. 13
Nov. 18. Saint Clairsville, O.......Nov. 6
Nov. 18. Lakewood, O. ....Nov. 13
Nov. 18. Norfolk, Va. ....Nov. 13
Nov. 21. Santa Fe, N. Mex.........Nov. 6
Nov. 28. Fort Morgan, Ala.........Nov. 6
Dec. 1. Phoenix, Ariz. ....Oct. 16
Dec. 2. Phoenix, Ariz. ....Nov. 13
Dec. 17. Camden, N. J..............Oct. 16

Miscellaneous.

Nov. 13. Chicago, Ill., Chimney, Nov. 6
Nov. 13. New York, N. Y., Fire Protection System, Nov. 6
Nov. 14. New Orleans, La., Monument, Oct. 16
Nov. 14. Jersey City, N. J., Fences, Etc., Nov. 6
Nov. 14. New York, N. Y., Steamboats, Nov. 6
Nov. 15. Charleston, S. C., Street Lighting, Sept. 11
Nov. 16. Charleston, S. C., Concrete Pier, Oct. 23
Nov. 16. Evansville, Ind., Street Sweeping, Nov. 13
Nov. 18. Dallas, Tex., Lock and Dam, Oct. 16
Nov. 18. Erie, Pa., Street Lighting, Nov. 6
Nov. 18. St. Paul, Minn., Cement Floor, Nov. 13
Nov. 20. New Orleans, La., Dredge, Oct. 2
Nov. 20. Ludington, Mich., Breakwater, Oct. 30
Nov. 20. Baltimore, Md., Garbage Disposal, Nov. 13
Nov. 21. Galveston, Tex., Jetty Work, Oct. 30
Nov. 21. Austin, Tex., Concrete Wall, Oct. 30
Nov. 21. Fort Sumter, S. C., Wharf, Oct. 30
Nov. 22. Fort Adams, R. I., Coal Bin, Sea Wall, Etc., Nov. 13
Nov. 23. Las Animas, Colo., Power Plant, Nov. 13
Nov. 25. Mobile, Ala., Locks and Dams, Oct. 2
Nov. 25. Pittsburg, Pa., Monument, Nov. 13
Nov. 27. Washington, D. C., Steamers, Nov. 13
Nov. 30. Fort Caswell, N. C., Bulkhead, Nov. 13
Nov. 30. Bloomsburg, Pa., Monument, Nov. 13
Dec. 2. Washington, D. C., Tow Boat, Nov. 13
Dec. 2. Meaford, Ont., Breakwater, Etc., Nov. 13
Dec. 4. Altoona, Pa., Garbage Disposal, Nov. 6
Dec. 18. Madison, Wis., Concrete Work, Wrecking, Nov. 13

Excavation, Earth anb Rock.

Nov. 15. Philadelphia, Pa., Dredging, Oct. 23
Nov. 16. Pine Bluff, Ark., Levee Work, Oct. 23
Nov. 18. St. Paul, Minn., Filling Grading, Nov. 13
Nov. 19. Fort Dodge, Ia., Drainage, Oct. 30
Nov. 20. Detroit, Mich., Dredging, Oct. 16
Nov. 20. Grand Rapids, Mich., Dredging, Oct. 30
Nov. 21. Galveston, Tex., Dredging, Oct. 30
Nov. 21. Mobile, Ala., Dredging, Oct. 30
Nov. 22. Newport, R. I., Dredging, Oct. 30
Nov. 23. Pesotum, Ill., Tile Drain, Nov. 13
Nov. 23. Hartford City, Ind., Ditch, Nov. 13
Nov. 25. Memphis, Tenn., Levee and Ditch, Oct. 30
Nov. 25. New York, N. Y., Dredging, Oct. 30
Dec. 2. Trenton, Ont., Railroad Work, Nov. 13
Dec. 3. Wausau, Wis., Drainage Ditches, Nov. 6
Dec. 6. Canton, N. Y., Ditch Work, Nov. 13

Materials, Machines, Supplies, Tools, Etc.

Nov. 13. New York, N. Y., Lanterns, Nov. 6
Nov. 13. Baltimore, Md., Boiler, Nov. 6
Nov. 14. Fort Morgan, Ala., Pumping Plant, Oct. 23
Nov. 15. Winnipeg, Man., Water Pipe, Oct. 9
Nov. 15. Philadelphia, Pa., Arc Lights, Nov. 13
Nov. 16. Washington, D. C., Granite Curbing, Nov. 13
Nov. 16. New Fort Lyon, Colo., Laundry Equipment, Oct. 30
Nov. 16. Washington, D. C., Laundry Equipment, Oct. 30
Nov. 18. St. Paul, Minn., Engine, Rock Drill, Nov. 13
Nov. 18. Portland, Ore., Hoisting Engines, Etc., Oct. 23
Nov. 19. Washington, D. C., Car Wheels, Conduit, Etc., Oct. 30
Nov. 23. New Orleans, La., Elevator, Nov. 6
Nov. 25. Atlanta, Ga., Pump, Pipe, Engine, Oct. 30
Nov. 27. Washington, D. C., Clock System, Nov. 6
Nov. 20. New York, N. Y., Fire Hose, Nov. 13
Nov. 20. Sonyea, N. Y., Boilers, Nov. 13
Nov. 26. Providence, R. I., Elevator Equipment, Nov. 13
Dec. 1. Phoenix, Ariz., Water Pipe, Oct. 16
Dec. 2. Vicksburg, Miss., Road Outfit, Nov. 13
Dec. 6. Washington, D. C., Pumps, Blocks, Rope, Etc., Nov. 13
Jan. 15. Manila, P. I., Pumps and Motors, Oct. 30

BIDS ASKED

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Los Angeles, Cal.—Until Nov. 25, by H. B. Ferris, Secy. Bd. Pub. Service, for constructing reinforced concrete bridge at Macy St

Fresno, Cal.—Until Nov. 23, by W. O. Miles, County Clerk, for constructing pile bridge over King River.

South Bend, Ind.—Until Nov. 22, by County Commissioners, for constructing concrete steel girder bridge over East Race on La Salle St.

Jasper, Ind.—Until Nov. 14, by M. A. Sweeney, County Auditor, for the construction of a 120-ft. steel bridge on the Jasper and Huntingburg Road, and a small steel bridge on Ireland and Sulphur Springs Road.

New Castle, Ind.—Until 10 a. m., Nov. 18, by Commissioners of Henry County, for removal of a steel bridge over Blue River.

Big Fork, Minn.—Until 9 a. m., Nov. 22, by E. L. Shultis, Village Clerk, for building one or two highway bridges.

Sidney, O.—Until Nov. 16, by County Commissioners for material and labor for construction of low truss bridge over C. H. D. R. R. on Michigan St.

Cincinnati, O.—Until noon, Nov. 29, by Fred Dreihs, Clerk County Commissioners, for work under specifications No. 692—repair of suspension bridge over Whitewater River in Whitewater Township.

Uniontown, Pa.—Until Nov. 15, by County Commissioners, for constructing a bridge.

West Chester, Pa.—Until noon, Nov. 14, by W. E. Pennypacker, Clerk County Commissioners, for repairs to county bridge at Chadds Ford.

Graham, Tex.—Until Nov. 20, by George H. McLaren, County Judge, for building two bridges over the Brazos River in York County. A $40,000 bond issue has been voted for bridges.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Mobile, Ala.—Until noon, Dec. 10, by U. S. Light House Engineer, Mobile, for the completion and delivery of three keeper's dwellings, with wharves, cisterns and privies for Southwest Pass Light Station, Louisiana.

Phoenix, Ariz.—Until 9 a. m., Nov. 20, by J. W. Dorris, Chairman Committee, for erection of a Y. M. C. A. building. Trost & Creighton, Architects, 412 Fleming Block.

Tempe, Ariz.—Until noon, Dec. 3, by Alfred J. Peters, Secretary Board of Education, for construction of a science building for the Normal School. Tentative plans, etc., with D. W. Millard, Fleming Bldg., Phoenix, Ariz. At the same time plans, specifications and estimates of cost will be received for a science building and for gymnasium and auditorium building. The cost of the two buildings is not to exceed $60,000.

New Haven, Conn.—Bids close Nov. 14 for construction of new church at Dunnell Ave. and Charles St. for Zion M. E. Church. Brown & Van Beren, Architects, 865 Chapel Street.

Washington, D. C.—Until noon, Nov. 16, by District Commissioners, for the construction of a 6-room addition to the Langdon School at 20th and Franklin Sts., northeast; also for an 8-room school building at the northwest corner of 4th and M Sts., southeast. Plans, etc., at Room 43, District Building.

Jacksonville, Fla.—Until noon, Dec. 10, by Geo. L. Drew, Secy. Committee, 106 Main St., for materials and labor required for building the new masonic temple and office building at Jacksonville, according to the plans and specifications prepared by the L. M. Weathers Co., Architects, Memphis, Tenn.

Ocala, Fla.—Until 3 p. m., Dec. 19, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office and Court House at Ocala.

Chicago, Ill.—Until 11 a. m., Nov. 16, by Department Public Works, 322 City Hall, for building 1-story warehouse at Belle Plaine Ave. and Robey St.

North Chicago, Ill.—Until noon, Dec. 2, by the Bureau of Navigation, Navy Department, Washington, D. C., for the construction of a commandant's house, six officers' houses, and a receiving guard house at the naval training station, Great Lakes, North Chicago, Ill. Plans, etc., with the commandant, naval training station, Great Lakes, North Chicago.

Chicago, Ill.—Until 4 p. m., Nov. 19, by W. B. Wickersham, Secretary Public Library, for building an iron and glass shed.

New Albany, Ind.—Until noon, Nov. 29, County Commissioners, for remodeling the county jail.

Flint, Mich.—Until Jan. 2, by D. E. Newcome, City Clerk, for construction of a city hall.

Ely, Nev.—Until Dec. 2, by J. F. Miles, County Clerk, for constructing court house and jail.

Remsen, N. Y.—Until 5 p. m., Dec. 7, by Walter G. Frank, Architect, 17 Clarendon Bldg., Utica, N. Y., for erection of the Didymas Thomas library building at Remsen.

New York, N. Y.—Until 10:30 a. m., Nov. 20, by Francis J. Lantry, Fire Commissioner, 157 E. 67th St., for labor and materials for additions and alterations to quarters of engine company 58, No. 81 W. 115th St., and to quarters of engine company 35, No. 223 E. 119th St. Security required is $500.

Cincinnati, O.—Until noon, Nov. 14, by Trustees, Memorial Association of Hamilton County, at office of Samuel Hannaford & Sons, Architects, for furnishing the necessary labor and materials for the decoration, light fixtures, seating and furnishings for the Soldiers and Sailors Memorial Building, Grant and Elm Sts.

Pawnee, Okla.—Until 2 p. m., Dec. 17, by Commissioners of Indian Affairs, Washington, D. C., for constructing dormitory at Pawnee School. Further information may be obtained from Geo. W. Nellis, Superintendent, Pawnee.

Danville, Pa.—Until noon, Nov. 26, by H. B. Meredith, Superintendent State Hospital for Insane, for the erection of a female infirmary building; a building for acute insane male patients, and a building for acute insane female patients. T. P. Reitmyer, Architect, Masonic Temple, Williamsport, Pa.

Lancaster, Pa.—Until 3 p. m., Dec. 30, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction of an extension, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring to U. S. Post Office at Lancaster.

Oakmont, Pa.—Until Nov. 29, by E. H. Taylor, Secretary, for constructing school in Penn Township.

Canton, S. Dak.—Until 2 p. m., Dec. 10, by the Commissioner of Indian Affairs, Washington, D. C., for furnishing materials and labor to construct and complete a laundry building with equipment at the Indian Insane Asylum, Canton. Further information may be obtained from Oscar S. Gifford, Superintendent, Canton.

Nashville, Tenn.—Until 3 p. m., Nov. 27, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction (including heating apparatus, electric conduits and wiring) of a new mailing platform and vestibule, and for miscellaneous betterments at the U. S. Custom House and Post Office at Nashville.

Alpine, Tex.—Until Dec. 10, by J. D. Jackson, for erection of 2-story school building.

Runge, Tex.—Until Nov. 20, by D. P. Airhart, for building church of concrete blocks.

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Clarksville, Ark.—Until 2 p. m., Nov. 15, by San Laser, chairman for labor and material for constructing 7,544 ft. of 3-ft. wide sidewalks, 3,365 ft. of 4-ft. wide sidewalk and 647 ft. of crossing.

Wilmington, Del.—Until noon, Nov. 26, by Francis A. Price, New Castle County State Highway Commissioner, for constructing 2.64 miles of macadam road. The official advertisement for the work will be found elsewhere in this issue. About $150,000 will be spent next year in New Castle County for new roads.

Chicago, Ill.—Until 10:15 a. m., Nov. 18, by Board Local Improvements, 216 City Hall, for constructing two 8-ft. cement sidewalks.

Lebanon, Ind.—Until 1 p. m., Dec. 2, by B. F. Simmons, County Auditor, for construction of six gravel roads of a total length of 66,950 ft.

Lebanon, Ind.—Until 1 p. m., Dec. 10, by B. F. Simmons, County Auditor, for the construction of a gravel road on the county line between Boone and Hamilton Counties.

Knox, Ind.—Until noon, Nov. 23, by Commissioners of Starke County, for the construction of two gravel roads in Oregon Township.

Peru, Ind.—Until noon, Dec. 7, by Charles Griswold, County Auditor, for establishment, grading, draining and paving of 23½ miles of gravel roads in Richland Township.

Lebanon, Ind.—Until 1 p. m., Dec. 14, by County Commissioners, for construction of gravel road on the county line.

Kansas City, Mo.—Until 11 a. m., Nov. 21, by E. A. Harper, City Engineer, for following street improvement work: 6 contracts for constructing artificial stone curb, 12 contracts for artificial stone sidewalks, 5 contracts for grading streets, 1 contract for repairing asphalt pavement, 2 contracts for constructing brick pavement and 1 contract for constructing macadam pavement.

St. Louis, Mo.—Until noon, Nov. 19, by H. R. Fardwell, Secy. Bd. Pub. Impvts., for 34 contracts for improving alleys by grading and paving with vitrified paving brick.

Brooklyn, N. Y.—Until 11 a. m., Nov. 20, by Bird S. Coler, Borough President, for regulating and repaving with asphalt in Classon Ave., the work including 3,620 sq. yds. asphalt pavement and 3,620 sq. yds. old stone pavement, to be relaid; also for regulating and repaving with granite pavement on Columbia St., work including 3,300 sq. yds. granite block pavement.

Norwood, O.—Until noon, Nov. 16, by Board Public Service, for grading and macadamizing Warren Ave. J. B. Stewart, 712 Traction Bldg., Cincinnati, O., is Engineer.

Lima, O.—Until noon, Nov. 19, by L. L. Crumrine, Secretary Bd. Pub. Wks., for grading and paving with vitirified brick the two intersecting alleys extending from Main St. to Elizabeth St., and from Spring St. to Elm St.

Madisonville, O.—Until noon, Nov. 13, by J. A. Conant, Village Clerk, for constructing cement sidewalk on Home Ave.

Fort Myer, Va.—Until 11 a. m., Nov. 23, by Capt. B. B. Hyer, Constructing Q. M., for construction of roadway leading to Q. M. shop.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Du Pont, Del.—Until 11 a. m., Nov. 25, by Capt. J. L. Knowlton, Constructing Q. M., Fort Du Pont, Delaware City, for remodeling sewer system and installing two sewage ejectors and ejector chamber, at Fort Du Pont.

Decatur, Ill.—Until 2 p. m., Nov. 15, by Board Local Improvements, for laying 12-in. vitrified tile sewer.

Springfield, Ill.—Until 3 p. m., Nov. 13, by Roy R. Reece, President Board Local Improvements, for laying 18-in. and 12-in. crock pipe sewer in North Grand Ave.

Kendallville, Ind.—Until 4 p. m., Nov. 22, by City Council, for construction of Richmond St. sewer. Bids for this work were opened Nov. 4, only one bid being received. This amounted to $6,674 and was rejected. Estimated cost of work is $6,465.

Richmond, Ind.—Until Nov. 20, by C. W. Merrill, President Board Public Works, for construction of two sewers, estimated to cost $10,000 to $12,000 each. Fred R. Charles, City Engineer.

St. Paul, Minn.—Until 2 p. m., Nov. 18, by R. L. Gorman, Clerk Bd. Pub. Wks., for constructing the St. Anthony Park sewer system, the work including the construction of sewers in portions of 29 streets.

Kansas City, Mo.—Until 11 a. m., Nov. 21, by E. A. Harper, City Engineer, for two contracts for constructing joint district sewers.

Buffalo, N. Y.—Until 11 a. m., Nov. 16, by F. G. Ward, Commissioner Pub. Wks., for constructing 10-in. tile sewer in Barton St.

Brooklyn, N. Y.—Until 11 a. m., Nov. 20, by Bird S. Coler, Borough President, for constructing sewer in 44th St., estimated to cost $14,343, a sewer in E. 4th St., estimated to cost $9,682, and three sewer basins..

White Plains, N. Y.—Time for receiving bids for the construction of the Bronx Valley trunk sewer has been extended from Nov. 7 to 1:30 p. m., Nov. 27. Frank N. Glover, Secy., 2 Grand St., White Plains. The official advertisement will be found elsewhere in this issue.

Canton, O.—Until Nov. 25, by B. F. Faust, Clerk Bd. Pub. Service, for constructing storm water sewers in Bridge St.

Youngstown, O.—Until noon, Nov. 21, by W. H. McMillan, Clerk Bd. Pub. Service, for labor and materials for sewering Ridge Ave.; also for sewering Fairview Ave.

Marion, O.—Until noon, Nov. 19, by Board Public Service, for construction of a sanitary sewer and cellar drain on Pleasant and Chase Sts., and for a storm-water drain on

Mound St. from Buckeye to Wood St. George Blum is Superintendent of Streets and Sewers.

Reading, Pa.—Until 2 p. m., Nov. 20, by Caleb Weidner, City Clerk, for construction of 27,600 lin. ft., 10-in. pipe sewer and 32,500 lin. ft. of 5-in. pipe sewer; also for extension of Northeastern intercepting sewer, construction of laterals in Canal and other streets, and extension of Rose Valley Creek sewer. Elmer H. Beard, City Engineer.

Harrisburg, Pa.—Until noon, Nov. 14, by W. H. Lynch, Commissioner of Highways, for constructing two sewers.

Newport, Pa.—Until Nov. 22, by P. G. Hertz, Clerk, for constructing sewer system, including 6,000 ft. of sewer. M. B. Cowden, Harrisburg, Pa., is Engineer.

York, Pa.—Until Nov. 14, by C. E. Brenner, Chairman Bd. Pub. Wks., for constructing sewer.

Milwaukee, Wis.—Until 10:30 a. m., Nov. 15, by Chas. J. Poetsch, Chairman Bd. Pub. Wks., for constructing pipe sewer in Read St., and pipe sewer in American Ave.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Phoenix, Ariz.—Until 2 p. m., Dec. 2, by Commissioner of Indian Affairs, Washington, D. C., for materials and labor for constructing addition to water system at the Phoenix School. Further information may be obtained from C. W. Goodman, Superintendent, Phoenix.

Grand Forks, N. Dak.—Until 4 p. m., Nov. 15, by W. V. O'Connor, City Auditor, for constructing water main in Ione Ave.

Lakewood, O.—Until 11 a. m., Nov. 18, by B. M. Cook, Village Clerk, for labor and material for laying water main in Nicholson Ave. Wm. H. Evers Engineering Co., 237 The Arcade, Cleveland, O., is Engineer.

Norfolk, Va.—Until noon, Nov. 18, by Board of Control, H. Hodges, Chairman, for furnishing and installing 2,000 ⅝-in. and ¾-in. water meters and boxes. Separate bids are also asked for installing above meters and boxes and for furnishing them.

Excavation. Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

Pesotum, Ill.—Tile Drain.—Until 2 p. m., Nov. 23, by Drainage Commissioners, at office of B. A. Hyatt, Town Clerk, for constructing tile drain, the work including 4,200 ft. of 16-in., 3,480 ft. of 15-in., 980 ft. of 14-in., 1,445 ft. of 12-in. and 600 ft. of 10-in. tile.

Hartford City, Ind.—Ditch.—Until 10 a. m., Nov. 23, by County Surveyor, for constructing ditch in Washington Township.

St. Paul, Minn.—Filling, Grading.—Until 2 p. m., Nov. 18, by George T. Redington, Secy. Park Board, City Hall, for the filling, leveling and grading of Como Avenue Parkway, lying between Western Ave. and Rice St.

Canton, N. Y.—Ditch Work.—Until 8 p. m., Dec. 6, by J. Fred Hammond, Secretary, Indian Creek Drainage Commissioners for the widening and deepening of the Van Rensselaer Ditch, at and near the village of Rensselaer Falls, in the town of Canton, N. Y. Work includes removal of about 26,000 cu. yds. of earth, and about 10,000 cu. yds. of rock. H. M. Townsley, Engineer.

Trenton, Ont.—Railroad Work.—Until noon, Dec. 2, by Geo. Collins, General Manager, Central Ontario Railway, at its General Offices, Trenton, Ont., for the clearing, grading, track-laying, ballasting and other works required in the construction of the Whitney Extension between the 24th mile, near Lake St. Peter, and Whitney, a distance of about 18 miles. Plans, etc., at the office of the Chief Engineer at Trenton, Ont.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Las Animas, Colo.—Power Plant.—Until 11 a. m., Nov. 23, by Bureau of Yards and Docks, Navy Department, Washington, D. C., for power plant, building and machinery at U. S. naval hospital, New Fort Lyon, Colo.

Washington, D. C.—Steamers.—Until 2 p. m., Nov. 27, by Beekman Winthrop, Assistant Secretary, Treasury Department, Washington, for building for the U. S. Revenue Cutter service a revenue steamer for duty in Puget Sound, and for the construction of a revenue steamer for duty at Savannah, Ga.

Washington, D. C.—Tow Boat.—Until 10:30 a. m., Dec. 2, by H. F. Hodges, General Purchasing Agent, Isthmian Canal Commission, for furnishing under Canal Circular 101—One stern-wheel tow boat.

Evansville, Ind.—Street Sweeping.—Until 2 p. m., Nov. 16, by W. F. Wunderlich, City Clerk, for the sweeping and cleaning of the brick and asphalt streets, for 1908.

Baltimore, Md.—Garbage Disposal.—Until 11 a. m., Nov. 20, by J. L. Wickes, Commissioner of Street Cleaning, for removal and final dispository of garbage, dead animals and market refuse of the city of Baltimore, from Jan. 1, 1908, until Jan. 1, 1918.

St. Paul, Minn.—Cement Floor.—Until 2 p. m., Nov. 18, by George T. Redington, Secy. Park Board, Room 42, City Hall, for laying a cement tile floor or a cement floor in Phalen Park Pavilion, 96x56½ ft.

Fort Caswell, N. C.—Bulkhead.—Until 11 a. m., Nov. 30, by L. Cravens, Q. M., for building creosoted bulkhead at this post.

Pittsburg, Pa.—Monument.—Until 2 p. m., Nov. 25, by F. P. Booth, County Controller, for constructing Allegheny County Soldiers' Monument at Pittsburg, Pa. Plans, etc., with County Engineer, Room 25, Court House, Pittsburg. Certified check for $5,000 required with bid.

Bloomsburg, Pa.—Monument.—Until noon, Nov. 30, by A. B. Black, Clerk County Commissioners, for constructing soldiers monument in Bloomsburg.

Fort Adams, R. I.—Coal Bin, Sea Wall, Etc.—Until 10 a. m., Nov. 22, by Capt. Willis C. Metcalfe, constructing Q. M., 209 Thames St., Newport, R. I., for construction of coal bin, sea wall and railway at the power house at Fort Adams, R. I.

Madison, Wis.—Concrete Work, Wrecking—Until noon, Dec. 18, by Lew F. Porter, Secretary Capital Commission, for building the concrete tunnel between heating and power plant and capitol now building at Madison; also a proposition for the wrecking of the east wing of the present capitol.

Meaford, Ont.—Breakwater, Etc.—Until Dec. 2, by Fred Gelinas, Secretary Department of Public Works, Ottawa, Ont., for construction of extension to breakwater, removal of portion of landing pier, construction of a pile and concrete revetment wall, and a line of tongued and grooved sheet piling, at Meaford, Ont., according to a plan and specification to be seen at the office of J. G. Sing, Esq., Resident Engineer, Confederation Life Building, Toronto. Certified check for $4,000 required with bid.

Materials, Machines, Supplies, Tools, Etc.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Granite Curbing.—Until 2 p. m., Nov. 16, by District Commissioners, for furnishing the District Government during the fiscal year ending June 30, 1908, granite curbing. Specifications, etc., at office of the Property Clerk, D. C., District Bldg.

Vicksburg, Miss.—Road Outfit.—Until noon, Dec. 2, by J. D. Laughlin, Chancery Clerk, for furnishing county with a steam road outfit.

New York, N. Y.—Fire Hose.—Until 10:30 a. m., Nov. 20, by Francis J. Lantry, Fire Commissioner, 157 E. 67th St., for furnishing and delivering 5,000 ft. of 3½-in. rubber fire hose for fire boats and 2,000 of 2½-in. rubber fire hose for fire boats.

Norfolk, Va.—Meters, Meter Boxes.—See under Bids Asked—Water Supply.

CONTRACTS LET.

The following contracts have been let recently:

Tucson, Ariz.—Railroad.—E. W. Hartman, of Tucson Contracting Co., according to reports for construction of a railroad from this city to the Catalina Mountains, 45 miles. Road is to be used for the mines owned by F. O. Johnson of St. Louis, Mo. Cost of road is reported at about $800,000.

Davenport, Ia.—Paving.—McCarthy Improvement Co., for paving alley with brick.

Monmouth, Ill.—Bridge.—J. Howard Jayne, at $1,500, for constructing bridge in Floyd Township.

Peoria, Ill.—Bridge.—Schmitt Contracting Co., Peoria, at $1,795, for constructing bridge in Elmwood.

Peoria, Ill.—Bridge.—Bloomington Bridge & Manufacturing Co., Bloomington, at $2,798, for bridge over Dry Run at University St.

Peoria, Ill.—Bridge.—Burnham & Ives, Bloomington, Ill., at $1,647, for rebuilding bridge in Hollis Township.

Fort Wayne, Ind.—Macadam Road. Wm. Busching, at $7,650, for constructing macadam road in Madison Township.

La Porte, Ind.—Bridge Work.—Rochester Bridge Co., at $1,376, for superstructures for four bridges; Wr. A. Steigely at $1,783 for substructure work.

Indianapolis, Ind. Sewer.—Wm. Yates & Co., at $2.37 per foot, for constructing sewer in Germania Ave.

Roachdale, Ind.—Saw Mill.—Thomas Hill & Co., at $15,000, for constructing and equipment of band saw mill for Cutsinger Sons & Co.

Independence, Kan.—Paving.—F. P. Dellone at $9,383 for paving Laurel and 6th Sts., and 5th St., and at $11,844 for paving 6th St.

Wichita, Kan.—Bridges.—Wichita Construction Co., at $6,400, for constructing five county bridges.

Hutchinson, Kan.—Flour Mill.—Wm. P. Carmichael Co., Fullerton Bldg., St. Louis, Mo., for 6-story reinforced concrete mill for the Larabee Flour Mills Co. All of the interior and exterior will be concrete, including stairs, cornice and roof. There will be brick curtain walls, however, for wall panels, but no brick veneering. The Carmichael Co., of which H. M. Cryder is Western Manager, has also been awarded contract for a 5-story reinforced concrete and brick mill at Stafford, Kan., for the Larabee Co.

Troy, Mo.—Bridge.—J. S. Kedwell, Warsaw, Mo., at $2,500, for 180 ft. steel suspension bridge over Cuivre at Davis.

Butte, Mont.—Storm Drain.—Peter Oren at following bid (bids opened Nov. 6) for constructing a cement pipe storm drain on Nevada Ave., 3d St., California Ave., 2d St., and Maryland Ave.: 3-ft. trench, excavating and back-filling, 35c per lin. ft.; 80 ft. 4-ft. trench, excavating and back-filling, 45c per lin. ft.; 1,490 ft. 5-ft. trench, excavating and back-filling, 60c per lin. ft.; 990 ft. 6-ft. trench, excavating and back-filling, 65c per lin. ft.; 995 ft. 13x18-in. pipe, in place, 86c per lin. ft.; 1,071 ft. 12-in. pipe, in place, 55c per lin. ft.; 302 ft. 10-in. pipe, in place, 44c per lin. ft.; 197 ft. 8-in. pipe, in place, 34c per lin. ft.; 1 3-ft. catch-basin, complete, $35 each; 5 4-ft. catch-basins, complete, $40 each; 5 5-ft. catch-basins, complete, $45 each; 4 6-ft. catch-basins, complete, $50 each. The custom of past administrations of this city has been to receive lump sum bids on sewer work, but in the future itemized bids will be required, and it is believed that a large saving will be made to the city, at the same time allowing the contractor fair profits with less risk than under the former system. Alexander Leggat, City Engineer.

Rochester, N. Y.—Subway.—J. W. Dwyer, Buffalo, N. Y., at $100,000, for excavation and masonry work for the Culver St. subway.

Rochester, N. Y.—Tower.—William Summerhays & Son, at $3,760, for erection of a ventilating tower for east side sewer at Norton and St. Paul Sts.

Syracuse, N. Y.—Electric Railway.—Syracuse & South Bay Electric R. R. Co., Thos. H. Mather, Chief Engineer, has awarded contract for completion of its road to J. A. Hodge & Co., Rochester, N. Y.

Hamilton, O.—Sewer Pipe.—Massillon Steel & Iron Co., at $32 per ton for 6 in., and $32.70 for 4-in. sewer pipe.

Toledo, O.—Bridge Abutments.—R. W. Johnson, at $2,200, for constructing abutments for bridge on Ottawa Terrace in West Toledo.

Allentown, Pa.—Sewer.—Geo. H. Hardner, for constructing sewer in Liberty St.

Kittanning, Pa.—Bridge Abutments.—T. T. Hague, for constructing abutments for bridge for Kittanning & Leechburg Rys. Co.

Lancaster, Pa.—Bridge Work.—James B. Miller, for repairing on Andrews, Steelville and Hunsicker bridges.

Philadelphia, Pa.—Bridge.—Richard Walsh, at $102,000, for construction of steel bridge over Frankford Creek on Wyoming Ave.

Philadelphia, Pa. — Paving. — Barber Asphalt Paving Co., Land Title Bldg., at $1.69 to $2.01 per yd., for asphalt repairing; Fillert Paving & Construction Co., 15th and Chestnut St., at $1.63 to $1.99 per yd., on similar work. D. J. McNichol, 24 sections of granite block paving at $2.73 per yd.; Mack Paving Co., two sections of granite block paving, and W. A. Ryan, six sections. Cunningham & Murray were awarded the contracts for paving with vitrified brick, and four sections of granite block paving.

Scranton, Pa.—Coal Breakers.—Kingsley & Westcott, 119 Wyoming Ave., for constructing four large breakers for Lehigh Coal & Navigation Co.

Scranton, Pa.—Sewers.—Frank Egli, at $5.98 per lin. ft., and Vincent O'Hara, at $4.16 per lin. ft., for constructing two short sewers.

Warren, Pa.—Buildings.—Wm. Hanicy, Bradford, Pa., for constructing state hospital buildings at this place.

Belle Fourche, S. Dak.—Ties.—W. H. Sutherland, Belle Fourche, for 300,000 ties for extension of C. & N. W. Ry.

Spokane, Wash.—Sewer.—J. V. Costello, at $22,650, for constructing subtrunk sewer in the First Ward.

Seattle, Wash.—Railroad Construction.—Advices from this city state that M. J. Heney, who built the White Pass & Yukon Ry., has been awarded the contract to construct the Copper River Northwestern Ry., the Guggenheim road from Cordova to the Copper River.

Wheeling, W. Va.—Bridge. — Riverside Bridge Co., Martins Ferry, O., for construction of overhead footbridge to span P. R. R. tracks at the pumping station.

Union, W. Va.—Water Works.—West Virginia Heating & Plumbing Co., Charleston, W. Va., for installing water works here.

PROJECTED WORK.

Railroads

Items Arranged Alphabetically by States.

Tucson, Ariz.—City Engineer Dietrich is reported to be chief of party engaged in making surveys for a line of railroad from this city to the Catalina Mountains, 40 miles distant, where mines are to be opened up by F. O. Johnson, of St. Louis, Mo. According to the report the contract for the construction of the road has already been let to E. W. Hartman, of the Tucson Contracting Co., at about $700,000.

Hot Springs, Ark.—Hot Springs, Ouachita & Mena Ry. Co. has asked State Railroad Commissioners for an extension of time in which to complete its road. Company proposes to build a railroad from Hot Springs to Black Springs. Five miles of the road bed line have been completed and surveys made for entire line.

San Diego, Cal.—Charter map and plans of the San Diego & Arizona R. R. have been approved by U. S. Government. Surveys for the road are now under way and have been completed from this city to the western edge of the desert. As proposed the road, which is a John D. Spreckels project, is to extend from San Diego to Yuma, Ariz.

San Diego, Cal.—Atchison Topeka & Santa Fe Ry., according to reports, will expend $200,000 here for terminal improvements, to include 10-stall reinforced concrete round house and machine shop. H. C. Phillips, Los Angeles, Cal., is chief engineer.

Thomasville, Ga.—State Railroad Commission has granted Central Florida Ry. Co. permission to issue $200,000 of bonds, proceeds of which are to be used for extending the road to the gulf. Road will extend from this place to the gulf, 67 miles, 37 miles of which has already been constructed.

Chicago, Ill.—With principal offices in this city and capital stock of $50,000, the Chicago & East St. Louis Short Line Ry. Co. has been incorporated. It is proposed at some future time to construct a steam railway between this city and East St. Louis. Those interested: H. C. Osterman, William M. Drennan, treasurer of the Osterman Manufacturing Co., West Pullman; H. C. Dolph of B. Nicoll & Co., iron merchants; Thos. W. Flynn, attorney, and William Anderson.

Indiana Harbor, Ind.—Indiana Harbor Belt R. R. Co., B. C. Rich, Chief Engineer, Gibson, Ind., has increased its capital stock.

Hannibal, Mo.—Agreement is stated to have been reached by city officials and C., B. & Q. R. R., regarding construction of a double track line along the river front and also for reconstruction of railroad yards in this city.

Jefferson City, Mo.—Jefferson City, Albuquerque & San Diego Valley R. R. Co., with capital stock of $7,000,000 and headquarters at Carthage, Okla., has been incorporated and proposes the construction of road from Jefferson City, Mo., through Kansas and Beaver County, Oklahoma, New Mexico and Arizona to San Diego, an approximate distance of 1,600 miles. The incorporators are J. H. Langston and O. S. Jent of Guymon, J. S. Harris, Carthage, Okla., W. F. Bort, Wichita, Kan., and C. R. Wright, Liberal, Kan.

Fairport, O.—Baltimore & Ohio R. R., E. Stimson, Chief Engineer M. of W., Cincinnati, O., is reported to be planning to construct a new line on the Painesville branch between West Farmington and Fairport.

New Cumberland, Pa.—Pennsylvania R. R. is said to be planning to construct two additional tracks through this place so as to relieve the congested condition of the Enola yards.

McKeesport, Pa.—Pittsburg & Lake Erie R. R. is to lay an additional track between this city and Glassport, it is said.

Bristol, Tenn.—Bristol & Kingsport Ry. Co., mentioned in our last issue, has elected ex-Gov. John I. Cox, President. F. H. Gothran is Chief Engineer. As proposed, the road is to connect Bristol and Kingsport, 30 miles distant. Surveys were to be started at once.

Columbia, Tenn.—Middle Tennessee R. R. Co., has been incorporated, and proposes the construction of a 20 miles railroad from Leatherwood Creek in Hickman County to a point in Maury County. J. W. Howard and R. G. Sparrow, of Columbia, are interested.

Electric Railways.

Items Arranged Alphabetically by States.

Selma, Ala.—Construction of an electric railway between this place and Marion and other points in Perry County is under consideration. According to advices from Selma preliminary surveys may be started shortly. J. T. Slater, Secretary Commercial and Industrial Association, is interested.

San Francisco, Cal.—City Engineer Thos. P. Woodward, according to reports, recommended to Board of Supervisors that the municipal street railway on Geary St. be entirely reconstructed. The work will cost $1,500,000.

Canon City, Colo.—Frank D. Heath has been appointed Superintendent of the construction, operation and traffic departments of the recently organized Canon City & Royal Gorge Electric R. R. Co., and has been instructed to prepare specifications and call for bids for the grading and construction for roadbed through the streets of this city.

Denver, Colo.—Interurban Construction Co., E. N. Reaser, President, which proposes to construct an interurban electric railway between this city and Greeley, Colo., is reported to have secured practically all of the necessary capital and will commence grading work within a short time.

Iowa City, Ia.—Henry Negus, an attorney, of Iowa City, and I. J. Hamiel, of Tipton, Ia., have asked franchise for new street railway in this city.

Bloomington, Ill.—Bloomington, Pontiac & Joliet Electric Ry. Co., H. A. Fisher, Joliet, Ill., President, has made a proposition for the extension of the road south from Pontiac to Bloomington and north from Dwight. The extension is conditional upon the people of the cities and country through which it passes subscribing for a certain percentage of the bonds of the company.

Bloomington, Ill.—At a recent meeting of the Corn Belt Traction Co., which proposes the construction of a trolley road between this place and Champaign. John Pitts, of Bloomington, was elected President and H. C. Billingsley, of Chicago, Vice-President.

Champaign, Ill.—St. Louis & Staunton Ry. Co., said to be a McKinley interurban project, has incorporated and proposes to construct a road from Edwardsville to a point in or near Staunton. The incorporators and first board of directors are George M. Mattis, W. H. Carnahan, C. Zilly, B. M. Bramble, and R. H. Watson, Jr.

Quincy, Ill.—Quincy Interurban Ry. Co., a local organization, has asked City Council for franchise to build and operate an electric railway over four miles of streets. It is planned to later extend the road to the country.

Springfield, Ill.—The directors of the St. Louis, Terre Haute & Quincy Traction Co., organized to build an interurban railway between this city and Terre Haute, and, later, a branch to St. Louis, have called a meeting of the stockholders for December 3, at which time the question of removing the headquarters from Springfield to Quincy, Ill., and the proposition to increase the capital stock to $50,000 will be voted on. The plans and estimates have been completed for a road from Taylorville to Quincy.

Woodstock, Ill.—Woodstock, Marengo & Sycamore Electric Ry. Co., with nominal stock of $25,000, and principal office in Chicago, Ill., has been incorporated and proposes to construct an electric railway from Woodstock through McHenry and De Kalb counties to Sycamore, Ill. The incorporators and directors are Charles A. Spenny, Edward B. Harang, M. W. Powell, H. S. Hedberg, and E. C. Spinney.

Marion, Ind.—The Logansport & Marion Traction Co., Marion, will soon ask for bids for the construction of an electric railroad from Marion to Logansport. A. G. Jenkins is Chief Engineer.

Cadillac, Mich.—It is reported here that the R. G. Peters Salt & Lumber Co., of Manistee, Mich., will build an electric railway between Manistee and this city. That company now has a narrow gage railway which runs within eight miles of this city. This roadbed is in excellent shape and it would require very little work to put it in shape for the roadbed of the proposed electric line.

Kansas City, Mo.—Right of way has been granted Blue Valley Electric Ry. Co. for an electric railway on the Blue Ridge road, 49th and Swope Park highway to a point east of the Blue River. The company has secured necessary capital and construction work will be started shortly, it is said. Alexander Massey is President and D. W. Pike is Chief Engineer.

Mirabile, Mo.—Missouri Valley Traction Co., recently incorporated to build an electric railway from St. Joseph to Excelsior Springs and Mirabile, has elected the following officers: Thos. B. Campbell, St. Joseph, President; L. L. Frost, Mirabile, First vice president; W. A. J. Bell, Excelsior Springs, second vice president; A. M. Bates, Excelsior Springs, treasurer; Horace G. Krake, St. Joseph, secretary. Surveys are to be started at once.

Red Lodge, Mont.—Russell Kimball, a civil engineer employed by the Red Lodge Board of Trade to make a preliminary survey and estimate of the cost of building an electric railway between Red Lodge and Bear Creek, has concluded his survey and has made his report to the board. The survey gives a route 10.11 miles long, with a 4 per cent grade. The engineer estimates that it will take approximately $200,000 to build and equip the line.

Moorhead, Minn.—Northwestern Interurban Ry. Co., organized to build an electric railway to connect Fargo and Moorhead with Detroit Lake, has filed its articles of incorporation. Principal office is to be at Moorhead. H. A. Coghlan, S. A. Anderson and J. R. Turner are the incorporators.

Frederick, Okla.—Oklahoma City & Southwestern Interurban Company has been chartered with $2,250,000 capital stock and headquarters at Frederick. It proposes to build an interurban line from Oklahoma City to Hollis, in Greer county, 190 miles. The cost of construction is estimated at $10,000 per mile. The incorporators are C. A. Swartz, J. P. Van Allen, S. W. Johnson, O. D. Reed and C. E. Richardson of Frederick; H. W. Curry of Eaton, O.; J. N. Street of Bloomington, Ill.; Frank B. Lucas, Samuel Ecker, Jr., J. W. Woodworth and Thomas R. Clift of Guthrie.

Sewers.

Items Arranged Alphabetically by States.

San Francisco, Cal.—Ocean Shore Realty Syndicate has had plans and specifications prepared for a permanent sewer system and water works for its lots at Brighton Beach. Contract for installing part of water system has aleady been let.

Forsyth, Ga.—City has voted to issue $75,000 of bonds for installing sewer system.

Canton, Ill.—Former City Engineer Chandler has prepared map of supplementary sewer system which it is proposed to install here. Matter will be voted on by citizens.

Carrollton, Ill.—Commercial Club has appointed committee, Dr. Howard Burns, chairman, to take up matter of securing sewer system for this place. System could be constructed for about $9,000.

Harvard, Ill.—Board Local Improvements has passed resolution for construction of sewage purification plant; also for several 18-in., 15-in., 12-in. and 10-in. sewers.

Princeton, Ind.—Plans are stated to have been completed for sewer system, including septic tank, for this city.

Vincennes, Ind.—Indiana Sewer & Drainage Co. has made propositon to sell to city its plans, etc., for a sewer system and all its appurtenances in this place.

Grand Rapids, Mich.—L. W. Anderson. City Engineer, is preparing plans for 8-ft. trunk sewer to form continuation of Broadway sewer. Improvement will cost about $90,000, and work will include two pumping stations on West Side.

Howell, Mich.—For the second time this place has voted against the issuance of $25,000 of bonds for installing sewer system.

Tecumseh, Mich.—Weage & Swonk, Coldwater, Mich., at $34,815, were low bidders Oct. 28, for installing sewer system for this village. Riggs & Sherman, Toledo, O., are the engineers.

Joplin, Mo.—Ordinance will come before City Council calling for special election to vote on issuing $86,000 of bonds for sewer work. Election may be held next month.

Elko, Nev.—Elko Chamber of Commerce is to secure engineer to furnish estimates of cost of installing sewer system for this town.

Cornwall, N. Y.—Plans have been prepared for a sewer system for this place to cost about $60,000.

Syracuse, N. Y.—Preliminary surveys have been started for the intercepting sewer system of this city. H. C. Allen is city engineer.

Columbus, O.—Certain parts of the Peters Run sewer are to be reconstructed.

Columbus, O.—Ohio Realty & Construction Co. has had plans made for a $6,000 sewage disposal plant for its property in Grand View.

Girard, O.—C. L. Allen, Marion, O., at $19,329, was low bidder Nov. 5, for constructing portion of trunk sewer for this city.

El Reno, Okla.—City has disposed of $25,000 of bonds, and work on extension of sewer system will be started at once.

Big Run, Pa.—State Health Department has directed this place to construct sewage disposal works.

Chambersburg, Pa.—This city has voted against the issue of $105,000 of sewer bonds.

Allegheny, Pa.—Permit has been granted for erection of $10,000 sewage disposal plant for City Home at Claremont. Simon Kirschler is Director of Charities.

Easton, Pa.—Report of A. P. Folwell, Consulting Engineer, Flatiron Bldg., New York, outlining plans for operation of city sewer system and for a sewage disposal plant and garbage disposal plant has been submitted to the council by Mayor F. A. March, who recommends that a bond issue of $240,000 be made for the work.

Harrisburg, Pa.—Engineers for the State Health Department are examining sewer outlets of various towns in the Monongahela Valley which dispose of their sewage into the Monongahela River. It is reported that a number of the towns will be required to erect sewage disposal plants.

Harrisburg, Pa.—Elkwood Sewer Co., W. S. Burns, president, which owns sewer in Elkwood, proposes to extend its system.

Pitman, Pa.—Plans and specifications for sewer system here have been submitted to Borough Council.

Prospect Park (P. O. Rhone,) Pa.—Borough Council has adopted ordinance for extension of sewer system.

Bingham, Utah.—Town aided by county will build sewer.

Water Supply.

Items Arranged Alphabetically by States.

El Dorado, Ark.—Town Water Works Committee will soon start its engineer making surveys for projected water works.

Grand Junction, Colo.—Election was held last week to vote on issuing bonds for the construction of a mountain water supply system.

Waterloo, Ia.—City has voted to purchase or construct water works.

Carbondale, Ill.—Citizens' Water, Light & Power Co., capitalized at $750,000, has been incorporated to take over water and light properties in this city.

Markle, Ind.—Water works is to be installed here.

Pittsburg, Pa.—County Commissioners have granted permission to the Clemens & Son Coal Co. to extend water mains across the public highway to their new mines west of Mulberry.

Grand Rapids, Mich.—The Board of Public Works will make application to the council for a bond issue for $200,000 for improvements in the city water works system. L. W. Anderson is city engineer.

Morenci, Mich.—This village has voted to issue $90,000 of bonds for water works and improving sewer system.

Sauk Rapids, Minn.—City is having plans and specifications made for new $25,000 water works.

Jackson, Miss.—Election is to be held Nov. 19 to vote on issuance of $216,000 of bonds for purchase of local water works.

Meridian, Miss.—Meridian Water Works Co. will expend $50,000 for water main extensions.

Brookfield, Mo.—City has voted $11,000 of bonds for improving water works.

Gallup, N. Mex.—This place has voted to issue $20,000 of bonds for constructing new reservoirs, new well and purchase of pumps.

Kimball, Neb.—Village Trustees have been petitioned to call election to vote on issuing $17,000 of water works bonds.

Wood River, Neb.—Village has voted to issue $28,000 of bonds for water works and electric light plant.

Bainbridge, N. Y.—Plans are being prepared by E. F. Musson, C. E., for a reservoir and filtration plant.

McGraw, N. Y.—Surveys are being made for water works system. W. G. Stone, Utica, N. Y., is Engineer.

Seneca Falls, N. Y.—State Board of Water Supply has granted this city permission to construct municipal water works.

Salisbury, N. C.—This city has voted $300,000 of bonds for extension of water and sewer systems.

Burlington, N. C.—Election is to be held Dec. 3 to vote on issuing $100,000 of bonds for water works and sewers.

Galion, O.—A $100,000 water works bonds issue will be voted on at November election.

Pleasant Ridge, O.—Town Council has decided to lay water mains to city limits of Cincinnati in order to secure a supply from that city. Estimated cost of work is $21,000.

Alva, Okla.—This place has voted to issue $40,000 of water works bonds.

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MACADAM ROAD.

Wilmington, Delaware.

Sealed proposals, addressed in writing to the New Castle County State Highway Commission and endorsed "Proposals for building a macadam road in the county of New Castle and State of Delaware," will be received by said Highway Commissioner at his office, No. 1009½ Market street, Wilmington, Del., until 12 o'clock noon, Nov. 26, A. D. 1907, for the construction of a road in New Castle hundred leading from Wilmington from a point at or near Eden Park to the town limits of New Castle, a distance of 2.64 miles.

All said bids or proposals must be made upon blank forms to be obtained from said Highway Commissioner at his said office, and must be accompanied with a certified check for $500, payable to the president of the Levy Court of New Castle county, or with a bond to the State of Delaware in the sum of $500, as surely that if a proposal be accepted, contract will be entered into.

Plans and specifications can be seen at the office of said commissioner. The right to reject any or all bids is expressly reserved.

FRANCIS A. PRICE,
New Castle County State Highway Commissioner. 20-1t

TRUNK SEWER AND TUNNEL.

White Plains, N. Y., Oct. 10, 1907.
Office of the Commission, No. 2 Grand St.

Pursuant to the provisions of Chapter 646 of the Laws of New York, 1905, as amended by Chapter 747 of the Laws of 1907.

SEALED BIDS, addressed to the Chairman of the Bronx Valley Sewer Commission and accompanied by a certified check for at least five per cent of the amount of security required for the faithful performance of the contract for each section bid upon, will be received up to November 7, 1907, at one-thirty P. M., for furnishing all the work and materials necessary for the watertight and enduring

CONSTRUCTION of each one of the seven sections which together comprise about twelve miles of circular sewer from three and one-third to six feet in diameter and about three miles of circular lined tunnel mostly six and one-half feet and eight and one-half feet in diameter. The material to be either monolithic reinforced concrete, reinforced concrete blocks or brick masonry.

PLANS and specifications may be seen at the office of the Commission. The Invitation to Contractors, the Form for Bids, the Specifications and the Form of Contract and Bond may be obtained from the Secretary of the Commission upon the payment of one dollar, to be repaid when the same are properly used in bidding.

FORM OF BID must fulfill the requirements of the Invitation and be made out upon the printed Form of Bid as above obtained and the Commission reserves to itself the right to reject any or all bids or to accept tbat one or those whose acceptance will, in its judgment, best secure the public interest and the efficient performance of the work mentioned.

FRANK N. GLOVER,
Secretary.

Office of the Commission, No. 2 Grand St.,
White Plains, N. Y., October 10, 1907.

Postponement of Date.

The time for opening of bids for the construction of the Bronx Valley Sewer is extended to Wednesday, November 27, 1907, at 1:30 p. m., at No. 2 Grand St., White Plains, N. Y.

19-3t FRANK N. GLOVER, Secretary.

USE
"Blaw System"
On Your Concrete Sewers and Conduits

Half Round Blaw Center, used for construction of invert and crown, showing method of support and finished concrete.
W. C. Mullins, Kansas City, Mo.

WRITE FOR CATALOG.

Blaw Collapsible Steel Centering Company
Westinghouse Building, Pittsburg, Pa.
New York Office, 320 Park Row Bldg.

CUT OUT MORE SHOVEL WORK

Street Superintendents
and other officials in charge of street clearing in winter are often badly crippled for want of efficient shovelers. Two

20th Century Graders

a team, a driver and two men following each grader will handle as much SNOW as eighty (80) shovelers. The job will be finished quicker, easier, with no fuss and leave the highway in a neat, presentable condition highly satisfactory to residents.

Railroad Contractors

need a 20th Century Grader continuously. For trimming down grades and finishing it is an ideal machine. One team and one man can do the work of twenty-five (25) men with shovels.

We have commendatory letters from railroad and street contractors. Write us to send you copies with our booklet "Delightful Roads." A postal will do.

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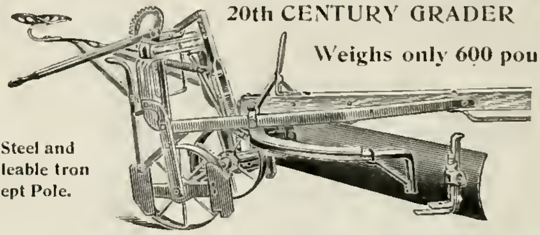

All Steel and
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Except Pole.

NOTICE TO CONTRACTORS.

Dancy Drainage District,
Wausau, Wisconsin.

Sealed bids will be received by the Commissioners of the Dancy Drainage District at the office of the Clerk of the Circuit Court in Wausau, Wisconsin, until 2:00 o'clock p. m., Tuesday, December 3d, A. D. 1907, at which time and place the Commissioners will attend and publicly open said bids.

The work upon which bids will be received are the Main Ditch and all of the branch ditches proposed to be constructed, plans for which have been heretofore approved by the Court.

Payments will be made in cash on monthly estimates to the extent of 80% of the work done during the preceding mouth and final payment upon the completion and acceptance of the work.

Plans, profiles and specifications are on file and may be seen at the office of the aforesaid Clerk of the Court, at the office of the Secretary of the Board of Commissioners at Dancy, Wisconsin, at the office of the Harman Engineering Co., 109 South Jefferson Ave., Peoria, Illinois, and at the rooms of the Western Society of Engineers. Monadnock Bldg., Chicago, Illinois. Copy of Specifications, Form of Bid and Form of Contract may be procured by calling upon or addressing the Harman Engineering Co.

The Commissioners reserve the right to reject any and all bids.

GEO. H. REYNOLDS,
J. P. MALICK,
GEO. G. KNOLLER,
Commissioners.

HARMAN ENGINEERING CO.,
Engineers, Peoria, Illinois.
October 28, 1907. 19-2t

PROPOSALS FOR STREET PAVING.

Columbia, S. C.

Proposals will be received by the Street Commission of the City of Columbia, S. C., until 12 o'clock m., November 25th, 1907, for paving Main Street with either Vitrified Brick, Wood-Block, Asphalt or "Bitulithic."

The work will embrace approximately 65,000 square yards of pavement, 17,000 lineal feet of combined concrete curb and gutter, and 4,500 lineal feet of concrete storm drains.

Plans are on file and may be seen at the office of the Street Commission at Columbia, or at the office of the Engineer at Winston-Salem, N. C.

Specifications will be ready and may be obtained from the Engineer after Oct. 30th.

Proposals will be opened publicly with the usual rights reserved.

J. L. LUDLOW, Engineer,
Winston-Salem, N. C.
CHAS. NAREY,
18-3t Chairman St. Commission.

MUNICIPAL CIVIL SERVICE COMMISSION,
299 Broadway.
New York, October 31, 1907.

PUBLIC NOTICE IS HEREBY GIVEN that applications will be received from THURSDAY, OCTOBER 31, UNTIL 4 P. M., WEDNESDAY, NOVEMBER 27, 1907, for the position of

TOPOGRAPHICAL DRAFTSMAN.

The examination will be held on Thursday, December 19, 1907, at 10 a. m.

The subjects and weights of the examination are Technical, 5; Experience, 2; Mathematics, 2; Neatness, 1.

Vacancies constantly occur. The salary is $1,200 per annum and up.

The provision of clause 12 of Rule VII., to the effect that "no person who has entered any examination for appointment to a competitive position and failed therein or who has withdrawn therefrom, shall be admitted within nine months from the date of such examination to a new examination for the same position," is waived so far as it applies to this examination.

For further information apply to the Secretary.

19-3t FRANK A. SPENCER, Secretary.

PROPOSALS FOR WATER PIPE.

Office of the Superintendent of the Water Department of the City of Phoenix, Ariz., September 25, 1907.

Separate bids will be received by the Superintendent of the Water Works of the City of Phoenix, Arizona, at the office of the said Superintendent, up until 3:30 p. m., of December 1, 1907, for the following:

1. Furnishing all material and labor for the completion of contemplated improvements.
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3. Necessary work for the installation of the same.

Specifications can be obtained, upon application, from the Superintendent, at City Hall, Phoenix, Arizona.

A certified check for five per cent of the amount of the bid, made payable to Frank Thomas, Recorder for the City of Phoenix, is to accompany each proposal, to be held as a guarantee that a contract with bond approved by him will be entered into by the party whose bid is accepted, in accordance with the terms of the said bid.

The Superintendent reserves the right to reject any or all bids, in whole or in part.

ROBT. CRAIG,
Superintendent.

U. S. ENGINEER OFFICE, Portland, Oreg., Oct. 18, 1907. Sealed proposals for furnishing and delivering four hoisting engines, three locomotives and two boilers will be received here until 11 a. m., Nov. 18, 1907, and then publicly opened. Information furnished on application. S. W. ROESSLER, Lt. Col., Engrs. 17-4t

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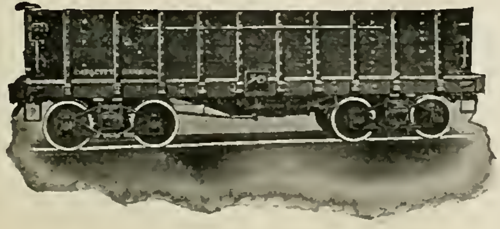

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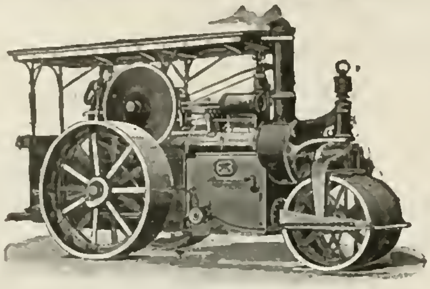

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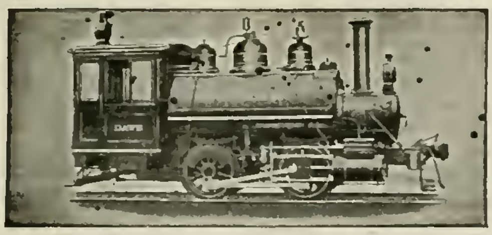

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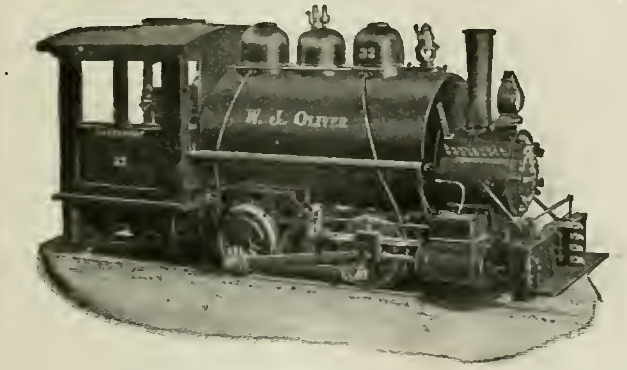

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Should Every Engineer Know Actual Costs Instead of Contract Prices?

The average civil engineer, until very recent years, has been satisfied with the possession of a knowledge of "typical contract prices" of such work as he would be likely to be called upon to estimate. This superficial knowledge of "costs" was deemed sufficient for any engineer's purposes, unless the engineer expected to be employed by a contracting firm. If an engineer knew that the average contract price for concrete was $6 a cu. yd., brick pavement, $1.70 a sq. yd.; heavy timberwork, $35 per M.; steel bridges, 4½ cts. a lb.; earth excavation, 25 cts., and rock, $1, a cu. yd.; and the like; he felt that his knowledge of "costs" was sufficient, and smiled incredulously when it was hinted that, to be a really first class engineer, he ought to be able to analyze the actual costs in any particular case with as great exactness as any contractor.

This attitude of indifference to actual costs is less popular than it once was, and we predict that ten years hence a civil engineer who can not give a close analysis of costs will be regarded as being only half educated.

Let us consider briefly some reasons why a knowledge of contract prices is insufficient. A contract price for earthwork on one job may be 17 cts. and on another it may be 27 cts., yet the percentage of profit may be identical. A variation in the length of haul, or in the character of the earth, or in the average depth of cut and contour of the ground, or in the size of the job, may account for this difference of 10 cts. per cu. yd., to say nothing of specified requirements as to rolling, trimming, and the like. It is clear, therefore, that an engineer would have to possess an almost infinite number of contract prices, with a statement of controlling conditions for each, before he could use contract prices as a reliable guide in estimating. Even if numerous contract prices, accompanied by conditions, were available—which they are not— it takes but the most casual study of contract prices to show their untrustworthiness. Examine the bidding prices of reliable firms on almost any piece of work, and estimate the difference in percentage. The result is amazing.

But, it is urged, if contract prices fluctuate, so do prices of materials; and, if an engineer should be able to estimate the actual costs to a contractor, it is equally reasonable to demand a knowledge of the actual cost of cutting and sawing lumber, or of mining and smelting copper. This objection is readily answered. Materials, it is true, fluctuate in price, but not so much because of fluctuation in actual cost production, as because of variation in supply and demand. Contract prices, on the other hand, vary greatly in different localities due to local conditions. Moreover, contract prices are compounded of three elements: 1st., prices of materials; 2d., cost of labor; 3d., margin allowed for contingencies and profit. As to the second and third items, it is evident that the individual judgment of bidders will vary, often between wide limits. While it is clear that fair market prices are easily ascertained by an engineer, it is equally clear that fair contract prices are not—at least in many instances. Hence every engineer who is likely to be called upon to estimate the probable cost of work—and who is not—should aim to become an expert in cost analysis, for it is only by a synthesis of analyzed costs that anyone can hope to predict actual costs with accuracy under varying conditions.

If this were the sole object of studying actual costs, it would be sufficient. There is, however, another object which is frequently of even greater importance. Most engineers insert restrictive clauses in specifications with very little conception of their influence upon actual costs. They form the opinion that a certain restriction or requirement will secure a "better" structure, and they make it a part of the specification. Rarely do they apply any logical criterion to ascertain how much "better" a structure becomes by virtue of a specification clause that adds to its cost. We recall, for example, a specification that required the sides of the spillway canal to be left with no projection or depression greater than 6 ins. from the neat lines shown in the plans. We estimated that it would cost $100,000 to live up to this requirement, because it would be necessary to drill a line of holes not over 6 ins. apart on each side in order to make the rock—a porphyry—cleave along an approximate plane. Channeling machines could not be used economically in a rock of this character, and, if they could have been used, the cost would have been very great anyway. We can not believe that the engineer who inserted the clause in the specification requiring such close adherence to the neat lines had the slightest idea that its fulfillment would cost any great sum of money, for there was really no necessity of having smooth sides, since the canal was designed unnecessarily large in cross-section for the purpose of securing enough rock to make a rock-fill dam. But the requirements looked well in the specifications, and it conformed with precedent as to other canal work.

Instances like this can be multiplied without number. Specifications swarm with economic blunders arising solely from lack of knowledge of actual detailed costs. So long as engineering colleges neglect to teach cost analysis, and so long as graduate engineers fail to educate themselves in costs, we shall see economic blunders perpetuated in specifications from one generation to the next, enlivened, now and then, by some novel mistake of an engineer even more ignorant of costs than his predecessors.

Thus, whether it be for the purpose of prognosticating costs with accuracy, or for the purpose of designing and directing the building of a structure that shall serve its function at a minimum of expense, every engineer should aim to become a cost-analysis engineer, and a master of construction economics.

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Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Method of Constructing Reinforced Concrete Towers for the Lincoln Light & Power Co's. Transmission Line, Ontario.*

This paper describes the reinforced concrete towers, built for the Lincoln Light & Power Co., on each side of the old Welland Canal, in the Province of Ontario, to transmit current from the transformer building to St. Catherines, Ontario.

These towers are 150 ft. high, 142 ft. being above ground. They are 11 ins. square at the top and 31 ins. square at the bottom, with chamfered corners, and are provided with foot steps and rungs. Each tower carries 16 No. 1 bare copper wires on glass insulators. The cross-arms are 3¼ by 4 ins. and are 10 ft. long, and beneath them there is a working platform about 10 ft. long and 5 ft. wide. The span over the canal is 76 ft., but adjacent to this span there is a span of about 300 ft. On one of the towers the wires run vertically, being fastened to two frames, 42 and 82 ft., respectively, from the top. At the top of this tower there is a heavy pull parallel to the line, which at this point makes a right-angled turn.

The collapse of a tower on a transmission line, caused by a storm, would be a very serious matter, and would be likely to cause lawsuits, the loss of light and power customers, and, perhaps, loss of life, on account of the dangerous currents.

These towers have been designed to withstand wind pressures of 30 lbs. per sq. ft. on flat surfaces, and 15 lbs. per sq. ft. on cylindrical surfaces. A liberal assumption was made by calculating the exposed surface of the wire as its diameter plus a coating of ice ⅜ in. thick multiplied by the span. As the greatest wind pressures in that part of the country have never exceeded an average of 30 lb. per sq. ft. on large areas, it is reasonable to believe that these towers are absolutely safe. The following conditions were observed in designing the towers:

Case I.—Tower, without wires, and not guyed; to withstand a pull of 2,000 lbs. at the top;

Case II.—Guyed tower; to withstand full wind pressure plus pulls transverse to the line, due to the wires;

Case III.—In case of the breakage of all the line wires—for 300 ft. span—the total pull to be taken on the guyed tower plus full wind pressure on the tower.

The calculations are based on the following assumptions: (1) The section plans before bending remains plane after bending; that is, the stress of any fiber is proportional to its distance from the neutral axis (Fig 1). (2) The applied forces are perpendicular to the plane of the neutral axis. (3) The tensile strength of the concrete is neglected. (4) There are no initial strains.

$$\frac{\text{Modulus of elasticity of steel}}{\text{Modulus of elasticity of concrete}} = 15$$

Ratio of cross-section of steel in tension to cross-section of beam above this steel	0.01129
Ratio of cross-section of steel in compression to cross-section of beam above the steel in tension	0.01129
	Lbs. Per Sq. In.
Compressive stress in the extreme fiber of concrete	600
Tensile stress in steel	16,000
Compressive stress in steel	6,350
Ratio of depth of steel in compression to depth of steel in tension	0.10714
Depth of steel in tension	28 in.

Case I.—The bending moment is 2,000 × 142.0 = 284,000 ft-lb. The distance from the compressive surface to the neutral axis, when the maximum allowable bending moment is applied, is:

$$\sqrt{2\times15\times(0.01129+0.01129\times0.10714)+15^2\times(0.01129+0.01129)^2}-15\times(0.01129+0.01129)]\times28=10.108\text{ in.}$$

The ratio of depth of neutral axis to depth of steel in tension is 0.3610

The moment of resistance is:

Taking moments about the center of compression in concrete.

$$\frac{31\times28^2\times\left[16\,000\times0.01129\times\left(1-\frac{0.361}{3}\right)+6\,350\times0.01129\times\left(\frac{0.361}{3}-0.10714\right)\right]}{12}=323\,700\text{ ft-lb}$$

Taking moments about the center of compression stress in the steel,

$$\frac{31\times28^2\times\left[16\,000\times0.01129\times(1-0.10714)-\frac{600\times0.361}{2}\times\left(\frac{0.361}{3}-0.10714\right)\right]}{12}=323\,700\text{ ft-lb.}$$

The compressive stress in the extreme fiber of the concrets, due to bending, is:

$$\frac{284\,000\times12}{31\times28^2\times\left[\frac{0.361}{2}\times\left(1-\frac{0.361}{3}\right)+\frac{15\times0.01129\times(0.361-0.10714)\times(1-0.10714)}{0.361}\right]}=529\text{ lb. per sq. in.}$$

The compressive stress in the steel, due to bending, is:

$$\frac{284\,000\times12}{31\times28^2\times\left[0.01129\times\left(\frac{1-0.361}{0.361-0.10714}\right)\times\left(1-\frac{0.361}{3}\right)+0.01129\times\left(\frac{0.361}{3}-0.10714\right)\right]}=5\,578\text{ lb. per sq. in.}$$

The direct compressive stress in the concrete, caused by the dead load of the tower above the point of maximum stress, due to bending, is:

$$\frac{63{,}300}{(19.6\times15)+(31^2-19.6)}=51\text{ lb. per sq. in.}$$

19.6 sq. in. = area of four rods

63,300 lb. = dead load.

The direct compressive stress in the steel, caused by the dead load of the tower above the point of maximum stress, due to bending, is:

$$\frac{63{,}300}{19.6+\frac{31^2-19.6}{15}}=769\text{ lb. per sq. in.}$$

The combined compressive stress in the extreme fiber of the concrete is:

529 + 51 = 580 lb. per sq. in.

The combined compressive stress in the steel is:

5,578 + 769 = 6,347 lb. per sq. in.

Case II.—

Diameter of wire	0.3 in.
Thickness of ice coating	0.75 in.
Total	1.05 in. = 0.087 ft.

Wind pressure per linear foot of wire = 0.087 × 15 = 1.3 lbs.

Weight of wire per foot	0.27 lb.
Weight of ice load per foot	0.324 lb.
Total	0.594 lb.

The resultant force, normal to the line, is:

$\sqrt{0.594^2+1.3^2}=1.43$ lb. per ft. of wire; and the total resultant force is:

$$\left(\frac{300\text{ ft. span}}{2}+\frac{76\text{ ft. span}}{2}\times1.43\right)\times16\text{ wires}=4\,300\text{ lbs.}$$

Vertical force on tower, due to resultant force	5 000 lbs.
Weight of cross-arms and platform	600 lbs.
Dead load of tower above the point of maximum fiber stress due to bending	63 300 lbs.
Total	68 900 lbs.

Area of four steel rods = 19.6 sq. ins.

---

*Extracted from a paper read before the American Society of Civil Engineers on Oct. 2, 1907, by Mr. D. W. Krellwitz and printed in the Proceedings for August, 1907.

The fiber stress in the concrete, due to direct compression, is:

$$\frac{68\ 900}{(19.6 \times 15) + (31^2 - 19.6)} = 56 \text{ lbs. per sq. in.}$$

In calculating the fiber stress due to bending, caused by wind pressure, the towers are considered as held at the top with

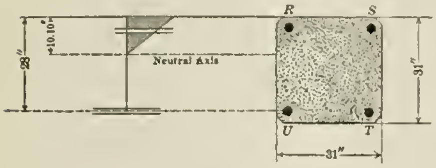


Fig. 1.

steel guys and fixed at the base (Fig. 2).

The wind pressure is: 247 sq. ft. × 30 lb. = 7 410 lb.
and the maximum moment due to wind is 118 200 ft.-lb.

The fiber stress due to direct compression is ..... 56 lb. per sq. in.
The fiber stress compression due to bending is ... 222 lb. per. sq. in.

The total compression in the concrete ... .. 278 lb. per sq. in.

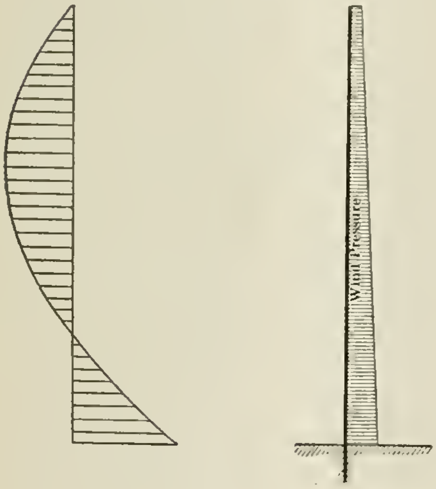


Fig. 2.

Case III.—

The area of one wire is 0.07 sq. in., and, in case all the line wires break, the pull is:

$0.07 \times 16 \times 60\ 000 = 67\ 200$ lbs.
The vertical force on the tower is .... 50 000 lbs.
The weight of the cross-arms and platform is .... 600 lbs.
The dead load of the tower, above the point of maximum fiber stress, due to bending, is .... 63 300 lbs.

Total .... 113 900 lbs.

The fiber stress in the concrete due to direct compression is:

$$\frac{113\ 900}{(19.6 \times 15) + (31^2 - 19.6)} = 92 \text{ lb. per sq. in.}$$

The maximum moment due to wind is the same as for Case II, or 118 200 ft.-lb.

The fiber stress due to bending is .... 222 lb. per sq. in.
The fiber stress in the concrete due to direct compression is ..... 92 lb. per sq. in.
The total compression in the concrete is .. 314 lb. per sq. in.

The unsupported length of tower is 52 times the maximum width and 77 times the average width. It would be of interest to know what "verified formula" would give the permissible strains per square inch for long reinforced concrete compression members.

A square cross-section, with four corner rods (*R*, *S*, *T*, and *U*), was chosen for the towers, as such an arrangement was more economical in steel than any other, each rod doing double duty. For instance, if the tower were strained about one axis, the rods, *R* and *S*, being in tension, if strained about another axis at right angles to the first, the rods, *S* and *T*, being in tension, the rod, *S*, would be doing double duty.

The tower at the right-angled turn of the line stood a remarkable test while changing the guys. On Aug. 2, 1906, it withstood the pull (tension in wires parallel to the line without any guy to resist this pull. The maximum deflection at the top was about 2 ft. Not having the necessary apparatus at this time, the pull could not be ascertained. There were no visible cracks, nor was there any movement at the base. On another transmission line, however, a 59-ft. tower showed movement at the base, because the base was not large enough.

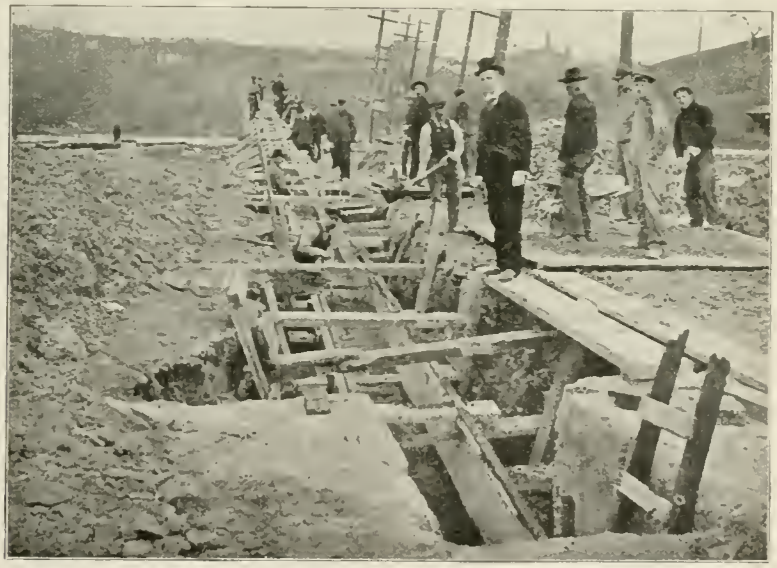


Fig. 3—Mold for Reinforced Concrete Towers.

The base of each tower was constructed with an opening on one side so that the foot of the tower could not slide horizontally during the erection. The finished base is a cube of concrete 10 ft. on each side, and having 8 ft. of the tower within it.

The molds for the towers were inclined from the base upward, as shown by Fig. 3, because the saving in erection more than offset the extra cost of excavating. While setting up the bottom sections on blocking, great care was taken to avoid unequal settlement. The side sections were set plumb, and braced properly to withstand the lateral pressures. The molds were wet (except in freezing weather) before placing the concrete. Cores were set to wooden templets near the top for the holes required for bolting the cross-arms. Holes, 2 ins. in diameter, were bored in the top side sections so that the bent ends of the foot steps would pass through when the molds were removed.

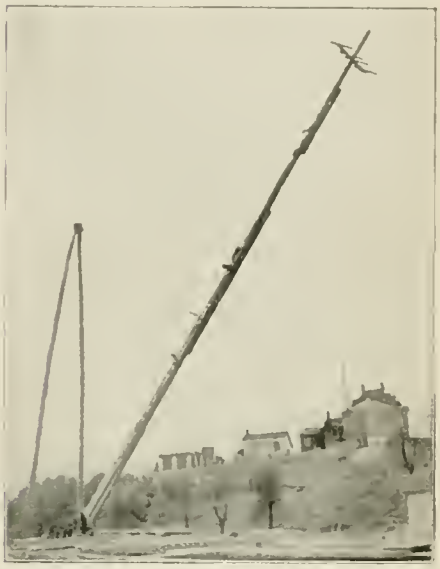


Fig. 4—Erecting Tower by Shear Legs.

The concrete for the towers was composed of 1 part of Portland cement and 5 parts of the very best gravel, with sand, of which 36 per cent was fine, having passed through a sieve of 0.2-in. mesh, and 64 per cent was coarse, being that which was retained in the sieve. The gravel, sand, and cement were first thrown together and turned over twice; water was supplied in pails, and the mixture was turned a sufficient number of times to produce a loose concrete of uniform color and consistency. Great care was taken in mixing the concrete and also in placing the steel and concrete.

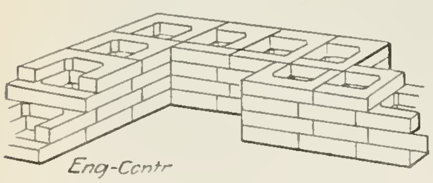
At intervals of 20 ins. foot steps were embedded in the upper part, and ladder rungs in the lower part, of each tower.

Two wooden shear legs, Fig. 4, with necessary steel back and side guys and steel hoisting tackle, were used in erecting the towers. Careful study was made during erection as to the proper positions of the hitches, in order to avoid any excessive deflections which might be caused by concentrated pulls during erection.

The last tower was molded on April 17, 1906, and the sides of the mold were removed two days later. Its erection was commenced on May 25, 1906, or 38 days after molding; smaller towers, however, have been erected successfully 14 days after molding. It is believed that these towers are the highest monoliths in existence at the present time, and it may be interesting to state that during their erection no men were injured in any way

A Concrete Brick Hollow Wall Construction.

The accompanying sketch shows a hollow wall construction of concrete bricks that possesses several features of distinct merit. The brick used, as will be noticed, is of special shape; it resembles very closely a block letter U, the arms of which form the inner and outer shells of the wall which the bottom piece bonds together across the wall. The depth of the bricks is 2⅜ ins., and the length of the face is 8 ins., or any other length desired. They are moulded regularly for walls 6, 9, 13, 17 and 21 ins. thick. The material used is a Portland cement, sand and fine gravel mixture, made so wet that it flows. This mixture is poured into molds and allowed to harden. When hard the bricks are removed from the molds and stored for 30 days until they are hard and ring when struck. The particularly interesting feature of this brick is its shape, which gives a thoroughly bonded hollow wall when laid as shown by the sketch. These bricks are made by the Composite Brick & Tile Roofing Co., of Baltimore, Md.



Sketch Showing Hollow Wall Construction.

Methods of Constructing Concrete Pavement at Windsor, Ont., with Notes on Cost.

Concrete pavement is constructed in all essential respects like cement sidewalk. The sub soil is crowned and rolled hard, then drains are placed under the curbs; if necessary to secure good drainage a subbase of gravel, cinders or broken stone 4 to 8 ins. thick is laid and compacted by rolling. The foundation being thus prepared a base of concrete 4 to 5 ins thick is laid and on this a wearing surface 2 to 3 ins. thick.

In constructing concrete pavement at Windsor, Ont., the street is first excavated to the proper grade and crown and rolled with a 15-ton roller. Tile drains are then placed directly under the curb line and a 6x16-in. curb is constructed, using 1-2-4 concrete faced with 1-2 mortar. Including the 3-in. tile drain this curb costs the city by contract 38 cts. per lin. ft. The pavement is then constructed between finished curbs.

The fine profile of the sub-grade is obtained by stretching strings from curb to curb, measuring down the required depth and trimming off the excess material. The concrete base is then laid 4 ins. thick. A 1-3-7 Portland cement concrete is used, the broken stone ranging from ¼ in. to 3 ins. in size, and it is well tamped. This concrete is mixed by hand and as each batch is placed the wearing surface is put on and finished. The two layers are placed within 10 minutes of each other, the purpose being to secure a monolithic or one piece slab. The top layer consists of 2 ins. of 1-2-4 Portland cement and screened gravel, ¼ in. to 1 in., concrete. This layer is put on rather wet, floated with a wooden float and troweled with a steel trowel while still wet. Some 20,500 sq. yds. of this construction have been used and cost the city by contract:

	Per. Sq. Yd.
Bottom 4-in. layer 1-3-7 concrete	$0.57
Top 2-in. layer 1-2-4 concrete	0.32
Excavation	0.10
Total	$0.99

This construction was varied on other streets for the purpose of experiment. In one case a 4-in. base of 1-3-7 stone concrete was covered with 2 ins. of 1-2-2 gravel concrete. In other cases the construction was: 4-in. base of 1-3-7 stone concrete; 1½-in. middle layer of 1-2-4 gravel concrete and ½-in. top layer of 1-2 sand mortar. All these constructions have been satisfactory: the pavement is not slippery. The cost to the city by contract for the three layer construction has in two cases been as follows:

Church St., 8,000 sq. yds.:	Per Sq. Yd.
4-in. base 1-3-7 concrete	$0.57
1½-in. 1-2-4 and ½-in. 1-2 mixture	0.32
Excavation	0.10
Total	$0.99

Albert and Wyandotte Sts., 400 sq. yds:	Per Sq. Yd.
4-in. base 1-3-7 concrete	$0.66
1½-in. 1-2-4 and ½-in. 1-2 mixture	0.39
Excavation	0.10
Total	$1.15

The cost of materials and rates of wages were about as follows:

Portland cement f. o. b. cars Windsor, per bbl	$2.05
River sand, excellent quality, per cu. yd	1.15
River gravel, screened, per cu. yd	1.25
Crushed limestone, ¼ to 3 ins., per ton	1.15
Labor, per day	$1.75 to 2.00

At these prevailing prices the contractor got a fair profit at the contract price of $1.15; at 99 cts., any profit is questionable, according to City Engineer George S Hanes, who gives us the above records. Expansion joints are located from 20 to 80 ft. apart and are filled with tar. Mr. Hanes writes that a large amount of this pavement will be built during 1908.

In a recent consular report the U. S. consul at Birmingham, England, describes a motor-propelled canal boat in use on the Birmingham canal. The boat is of the usual size and has a 15-h. p. two-cylinder motor, using a low grade of kerosene, locally called paraffin. The boat works with very little vibration. It is capable of carrying about 34 tons, but is loaded to only 26 tons, because so many canals need dredging. It has a 44-gallon kerosene reservoir over the screw and carries in addition a 44-gallon barrel of oil, and when loaded easily makes 4 miles an hour, which is about 1½ miles faster than the horse or mule propelled boats. Even when pushed to 6 knots an hour it does not wash the canal banks. The boat is used for carrying timber from Sharpness, on the coast, to Birmingham and back, a distance of 150 miles. The cost of running it, including engineer and assistant, works out at three-fourths pence (1 pence = 2 cts.) per ton mile, the boat making the trip to Sharpness and back, a distance of 150 miles, for 25 shillings ($5.08). The trip to Sharpness by canal includes a stretch of 13 miles from Birmingham to Tardabiggee without locks. In the remaining 13 miles to Worcester there are 57 locks. The journey then involves 30 miles on the Severn river, where the boat is locked at Gloucester into the Berkeley ship canal, whence it goes to Sharpness.

Appropriations aggregating $23,461,911 are desired by the Corps of Engineers, U. S. A., for fortification work during 1909. This contemplates work in the United States proper, Cuba, Honolulu, Porto Rico and the Philippines.

The Government of the Argentine Republic has recently authorized the Executive Department to expend $8,627,000 in works for enlarging and improving the accommodations for merchant shipping in the "Darsena Norte," Buenos Aires.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Daily Report Card for Recording Drilling Work.

In our issues of Oct. 2 and Oct. 23, we gave some forms for recording the daily work done by rock drillers. These forms were for work on railroads, canals, in quarries and similar work, and for steam drills or drilling done by hand. In this article we give some forms meant for well drilling, prospecting and deep hole blasting.

These forms are gotten up by the Cyclone Drill Co., of Orrville, Ohio, and are furnished to their customers for keeping records of drilling done by machines bought of them. The first blank illustrated in Fig. 1 is meant to record a day's work of well drilling or deep holes for blasting. From it the cost of drilling per foot can be calculated, showing in detail the labor cost, coal and oil and the cost of moving.

REPORT OF CYCLONE DRILL.

No......... ....
For..Shift
....190....
Number of feet drilled..............................
Number of hours worked..............................
Driller......................................hrs....
Helper.......................................hrs....
From.........to..................................feet
....

Paid for coal............ Paid for oil..............
Paid to move.........................
....
....
....Driller

Fig. 1—Blank for Daily Report on Drilling.

(Actual size of blank is 8 ins. high by 3⅝ ins. wide.)

The form shown in Fig. 2 is meant to be used for prospecting drilling, especially where a core is taken for record. The form is printed on the two sides of the sheet. It gives a time record, depth drilled, record of delays, materials and bits used, expense account for the day and a record of the drill holes showing cores taken and the depth and thickness of the strata drilled.

We are advised that these forms are being used by a large number of contractors, who find them very satisfactory.

Photographs and official data representing a summer's work of the International Boundary Commission in Alaska are reported to have been lost by the capsizing of a canoe in the Bradfield River.

The Cost of Plants for Bank Revetment with Mattresses on the Missouri River and Methods of River Improvement.

Mr. W. R. De Witt, U. S. Assistant Engineer, Sioux City, Iowa, in charge of the Missouri Survey from its mouth to Benton, Montana, made the following statement before the Inland Waterways Commission concerning the Missouri River and its improvement, at the meeting of the Commission, held Oct. 8, 1907 In answer to the question, "Is the Missouri River worthy of improvement?" Mr. De Witt replied, in part, as follows:

DAILY DRILLING REPORT.

Date..........................1905.
Contract No.....Hole No....Day of Week..........
For Whom...
Address...
Hole located near or at............................

TIME RECORD.

Name	Began Work Hr.	Began Work Min.		Quit. Hr.	Quit. Min.	
Driller, ...	....	....	..M	....	....	..M
Helper, ...	....	....	..M	....	....	..M
Helper, ...	....	....	..M	....	....	..M
Machine, Class.... No	....	....	..M	....	....	..M

DRILLING RECORD.

	Feet	Inches
Depth last Report..................	......	....
Amount drilled today................	......	....
Present depth of Hole...............	......	....

RECORDS OF DELAYS OR DIFFICULTIES.

....
....
....
....

MATERIAL RECORD.

Kinds of Core Barrel Used.	Time Used Hr.	Time Used Min.	Length of Cutting Element, whether Barrel or Bit. Before Ft.	Before In.	After. Ft.	After. In.
Standard...	....	....	....	....	....	....
Plain	......	....	....	....		...
Bit..........	....	....	....	....		....

Shot used pounds...... ....
Anything used in place of shot. .....

Fig. 2—Front of Blank for Daily Report on Prospecting Drilling.

(Actual size of blank is 8¾ ins. by 5¾ ins.)

About one-eighth of the entire population of the United States is directly interested and will be affected by the decision of this Commission, and I understand that Kansas City alone loses the sum of fourteen million dollars annually on account of the congested condition of the railroads and the present high freight rates. It seems to me, gentlemen, that it is a most worthy project to relieve this situation, and that we should be up and doing, realize its importance and go at it on a large scale and systematically.

Answering the first part of the question, it is respectfully stated that the work could be started within 24 hours after the order is given, and it is my humble belief that in one year boats could run from Kansas City to the mouth, in low water, without touching bottom, and that in 5 years' time the improvement would be practically complete, though the work would of course have to be maintained thereafter.

You might raise the question about the immense plant required to do this. In reply it is simply stated that one million dollars in plant would suffice for the entire work, and that after the work were completed this plant could be blown to atoms with dynamite and Kansas City would be ahead of the game just the difference between the one million spent for plant and the fourteen million lost annually by not having the plant and doing the work quickly.

EXPENSE RECORD.

Paid Whom.	For What.	Amount
....	....	....
....	....	....
....	....	....
....	....	....

SUPPLIES NEEDED.—HOW TO BE SHIPPED.—WHERE.

....
....
....

RECORD OF DRILL HOLE.

Kind of Strata Drilled Today.	Thickness Ft.	Thickness In.	Depth Ft.	Depth In.
....	......	......	......	......
....	......	......	......	......
....	......	......	......	......
....	......	......	......	......

To the Treasurer: I vouch for the truth of this report.

Signed.........
P. O. Address........ ....

Fig. 3—Back of Blank for Daily Report on Prospecting Drilling.

In former years, thousands of dollars have been spent in experimenting with constructing different kinds of plant. That experience would be valuable now and only the simplest kind of plant should be built.

It has been found that a willow mattress can be woven just as well and just as economically on a raft costing $100, as was woven in former years on specially constructed mattress boats that cost $6,000 each, and so with plant for other branches of the work. It is strongly recommended that as much of the money appropriated as possible should go directly into the work and not into building and maintaining expensive office boats and other useless plant.

The plant required for one construction party would consist of the following at cost shown:

4 barges (25'x100') at $2,500 each	$10,000
1 barge (20'x80')	2,000
1 hydraulic grader	5,000
1 steam pile driver	5,000
1 steam boat	5,000
	$27,000

This outfit, with 75 men, would improve two miles of river per year, or ten miles in 5 years, and ten such outfits would improve 100 miles in 5 years, at a plant cost of $270,000. It would not be necessary to have 10 graders and 10 pile drivers on any one division, as one party could be building pile dikes, requiring the pile driver, while another party could be building revetment, requiring the grader but no pile driver, so that $270,000 for plant for each division would be a very liberal estimate.

As to the character of the work, it is respectfully, though most urgently, recommended, that the major portion consist of bank revetment, only contracting the stream by means of pile dikes where it is absolutely necessary to confine the flow. It would certainly be good practice to maintain the channel along a stretch of rock bluff, simply by securing the soft bank opposite by revetment work, rather than to force the channel through the center of the valley by building pile dikes out from both shores, and not only good practice, but economy.

Another method of improvement would be that of maintaining dredges, to keep the shallow crossings cut out, but I believe you will all agree with me that, over such a long stretch of river, it would be economy to remove the cause rather than to constantly spend money to work on the effects. The cost of this dredge work would be many times the interest on the cost of improvement plus that of maintenance, and some of the results of making the banks stable would not be obtained by the dredge work, such as reducing flood height and preventing the enormous quantities of sand from pouring into the Mississippi River daily.

The method of improvement recommended, that of revetting the caving banks is no experiment, though it has never been done systematically and on continuous reaches of the river. This work properly constructed will stand for 20 years with little or no expenditure for maintenance; the bank below water is permanently protected against scour by the willow mattress and a little new rock placed occasionally on the upper bank will maintain that part of the work.

To revet all caving banks and contract the channel where necessary would cost but $50,000 per mile, the cost of a single track railroad including its terminals, and yet one boat on the river will carry a whole train load of freight and at less cost.

Nature has indicated the proper method of improvement by furnishing in every instance a rock bluff on one side of the river, where the rock required can be procured, and on the other side immense quantities of willow brush. These two materials, with a little wire to strengthen the mattresses while being sunk to the bed of the river, are all that are required in revetment construction, so that the major portion of the money expended would be for labor, in procuring the materials right along the river banks and then putting these materials together at the site of the work. The rock is inexhaustible, and while the present supply of willows is being exhausted, a new growth could be matured, it requiring only about three years for the willow brush to grow to a serviceable size.

A Wheelbarrow Bucket for Handling Concrete, Earth and Other Materials.

In charging concrete mixers the materials must be measured accurately and must usually be hoisted so as to be dumped into the mixing machine. The Bergen Point Iron Works of 149 Broadway, New York, have adapted their wheelbarrow bucket for this purpose.

Figures 1 and 2 illustrate this bucket. The central stem, by which the bucket is hoisted, has in it a wheel placed just forward of the center of gravity of the tub, so that, with handles attached to it, the tub becomes a wheelbarrow. The manufacturers state that a load of from 700 to 800 lbs. can be readily handled by a man on a smooth, level floor or on a track (see Fig. 1) that is level or has a light upward grade for the load. The handles can be detached quickly and the bucket hoisted by attaching a line to the central stem. The wheel and bearings are protected from dust and grit, and are lubricated by grease cups.

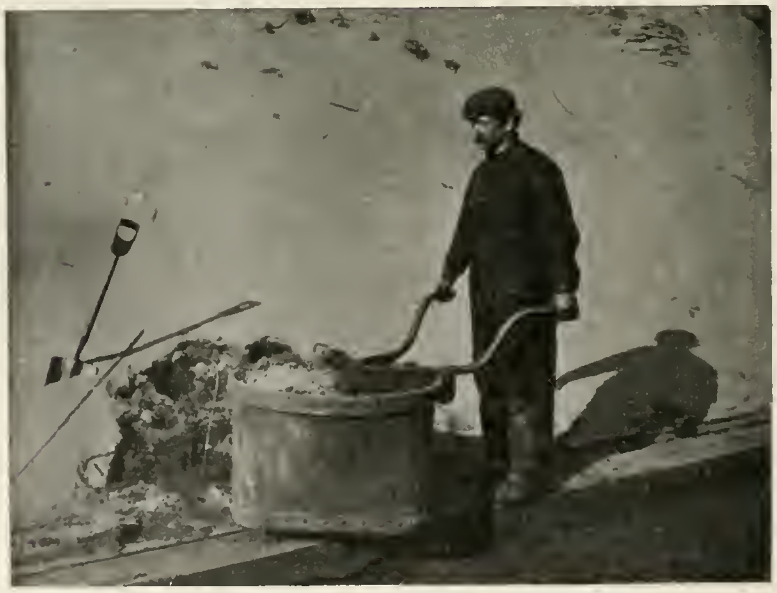


Fig. 2—Showing Bucket Used as Wheelbarrow.

The tub, being low, allows of rapid loading by men with shovels. By rows of rivets at various heights in the tub it is easy to measure proportions of concrete of six different mixtures, those most commonly used. The tubs can be loaded at stock piles, wheeled to the hoisting machine, and raised by power to the charging chute.

The cut in Fig. 3 shows this process. The power for the hoist is obtained from the engine on the concrete mixer. If a power cutoff is arranged on the mixer, the same horse power needed to revolve the mixer can be used to hoist the materials while the mixer is dumping. If it is desired to hoist the material while the mixer is revolving, a larger engine must be installed on the mixer.

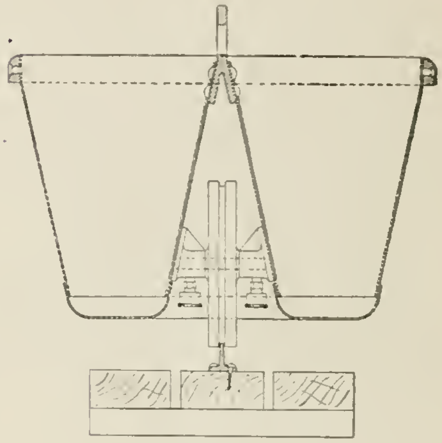


Fig. 1.

The pull on the single line carries the tub into the mouth of the chute and tips it so as to discharge the load. Slacking the line rights the bucket. The mechanical arrangements are such that no damage can result from overhoisting, so that extreme delicacy or skill on the part of the operator is not necessary. The chute of the dumping machine has a self locking gate so that it will act as a charging hopper. It is mounted on wheels and can be moved as easily as the mixer.

It is evident that in connection with the dumping chute, this bucket can be used for handling coal, sand, gravel, stone, concrete, earth and other materials that will dump by gravity. The bucket could be used in digging trenches and small tunnels for sewers. A track could be laid in the tunnel, and the tub wheeled by hand to a shaft where it would be hoisted and dumped. These tubs can also be transported by chain conveyors. They are made in three sizes, with a capacity of about 5, 9 and 20 cu. ft. The catalog of the company gives additional information.

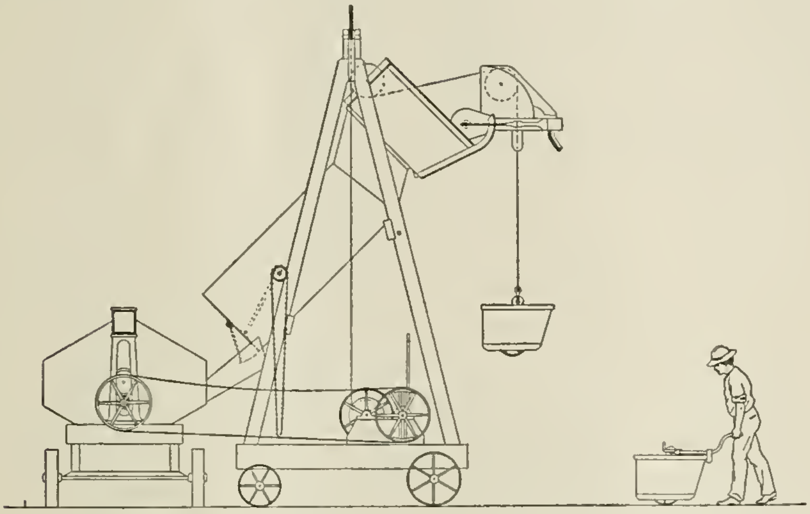
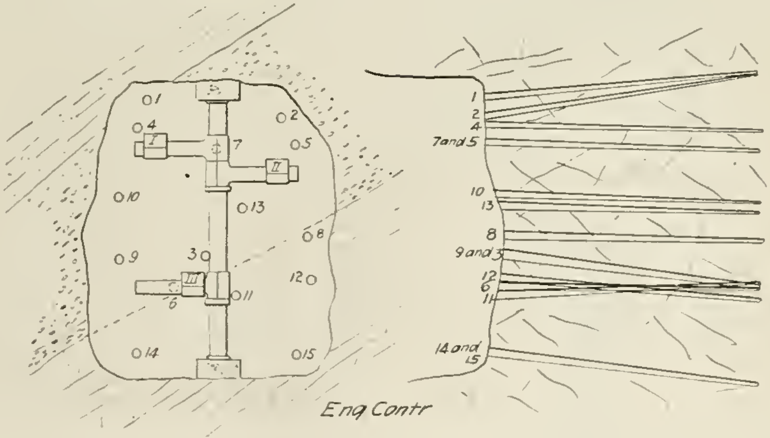


Fig. 3—Showing Method of Raising Bucket to Charging Chute.

Method of Drilling in Cinderella Mine, Transvaal.

In the Sept. 28, 1907, issue of the Engineering and Mining Journal, Edgar Nichols, mining engineer, Brakpan, Transvaal, gives a description of drilling holes with a bar upon which is operated three drills. We abstract the following from his article:

In the Cinderella Deep mine in the Transvaal the system of using three machines rigged on one bar, in pushing forward an ordinary 7x5-ft. drift, was introduced by Manager Girdler Browne. The use of this method established a record on the Rand for rapid driving, and this was performed at a depth of over 4,000 ft. from the surface. The advance was 225 ft. in a month of 31 working days. Three men with five or six natives and sometimes a white assistant worked in 8-hour shifts. Compressed air was freely used for blowing out the smoke and the rock was wetted after a blast. As soon as the rock was sufficiently shoveled back from the face the miner returned, set up the drills and started drilling while the rest of the rock was being removed. The rock had to be trammed 500 to 800 ft. On the Cinderella Deep the quartzites, forming the hanging wall of the blanket reef, are very hard. The reef itself is of moderate hardness and the dark quartzites or quartzose slates under the reef are usually fairly soft. The illustration shows a normal face bored out with 15 holes. The bore, which is usually a "double-jack" bar, is rigged as securely as possible about 4 ft. from the face. One arm is rigged, as shown, to put in a flat hole in the hanging wall; another is fixed directly below this to bore the roof hole on the other side of the drive. Safety clamps are put on under these two arms and also under the bottom arms. The third arm is rigged lower down to bore the top hole of a three-hole cut. This is generally put in to take advantage of the contact between reef and foot wall. The two dry holes and the cut hole are first slated and then the holes of the face are bored in the rotation shown by the numbers on the drawing. The top machines drill the shoulder holes, No. 4 and 5, without altering the arms.



Sketch Showing Method of Drilling with Three Drills Rigged on One Bar.

No. 1 machine drills holes 1, 4, 7, 10.
No. 2 machine drills holes 2, 5, 8, 11, 13.
No. 3 machine drills holes 3, 6, 9, 12, 14, 15.

Though No. 1 machine has only four holes to drill, the flat hole in the hanging wall takes so long that it is not finished much before the others; the No. 2 machine has all water holes to bore and should be rigged under the arm, drilling the lifter holes 14 and 15 before No. 2 machine comes down to drill hole 2. No. 2 machine has hole 13 to drill after No. 1 has drilled hole 10. If possible No. 1 machine is not given more to do after it has bored hole 10, as it is almost impossible to work with all the arms low down on bar. Very often when the foot wall ground is soft No. 3 finishes first and it can then be used to collar holes for the other machines. In the same way Nos. 1 and 2 machines can cross-collar difficult holes for each other. About four 1½-in. sticks of blasting gelatin are placed in each cut hole and from five to six in the other holes. The cut is blasted first, then the easers, then the shoulder and knee holes, then the back holes, and lastly the lifters. No. 8 hole is run in under the contact of reef and foot wall to prevent any lump being left on the side of the drift. The drift is run at a grade of one in 150 to 200 and has a single track with sidings every few hundred feet. It is considered quicker to run the drive 5x7 ft., as shown, and to use a single track only, than to take the drive out full width for a double track and to rig four machines. For a long drive the drift is squared off by hand labor to allow of a ventilating pipe being laid along the track. Before the regular work of stoping is started the drive is widened out and double tracks are put in.

According to the final report of the State Board of Equalization the total assessed value of taxable property in the State of Illinois for the year 1907 is $1,252,068,631. The amount is an increase of $125,401,974 over the aggregate assessed value as fixed one year ago. The foregoing assessment being based upon one-fifth of the actual value of all classes of property, the result establishes the aggregate value of taxable property in the state at $6,260,343,155.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Object Lesson Roads Built by the Government and Their Cost.

In the year book of the Department of Agriculture, Mr. L. W. Page, director of the office of Public Roads, has a paper on the work of his office from its inception in 1893.

Table I.—Data in relation to object lesson roads constructed in 1904-5.

Place.	Material used. Kind.	Source and transportation.	Dimensions of road. Length.	Width.	Depth.	Cost. Per square yard.	Rate per mile.	Cost of labor per day.
			Ft.	Ft.	In.			
Fernandina, Fla	Shells	Local	1,199	24	6	$0.348	$ 4,899.84	$1.00
Pensacola, Fla	Granite and trap	Ballast from Germany	506	32	6	.429	8,053.76	1 25
Jacksonville, Fla	Marl	By rail 250 miles	5,280	15	6	.592	5,211.03	1.25
Neosho, Mo	Novaculite	Local	2,640	12	7	.434	[a]3,055.36	1.00
Beaumont, Tex	Clam shells	By boat 28 miles	3,154	16	7	1.019	[b]9,565.01	....
Tallahassee, Fla	Sand - clay	Local	4,480	16	7½	.055	516.27	1.00
Pensacola, Fla	Sand - clay	Local	1,800	15	8	.140	[c]1,232.00	....
Gainesville, Fla	Flint	By wagon 6 miles	265	70	8	.278	11,416.53	1.00
Shreveport, La	Gravel	By rail 32 miles	3,306	16	8	.334	3,135.15	1.00
Walla Walla, Wash	Trap	By rail 13 miles	2,048	18	8	.415	4,382.40	1.50
Bellingham, Wash	Granite	By rail 30 miles	2,050	15	8	.785	6,908.00	2 00
De Kalb, Ill	Limestone	By rail 100 miles	4,510	12	8	.985	6,934.40	1.75
Gainesville, Fla	Sand - clay	Local	5,280	14	9	.107	881.25	1.00
Springfield, Mo	Novaculite	By wagon 2½ miles	1,310	16	9	.335	3,144 53	1.00
Arkansas City, Kans	Limestone	Local	3,615	14	10	.396	3,252.48	1.50
Chagrin Falls, Ohio	Sandstone and granite	Local	2,400	10	10	.800	4,693.33	1.50
Columbus, Ohio	Bricks and granite	Local	835	18	10	.976	[d]10,306.56	1.50
Lebanon, Mo	Novaculite	Local	2,950	9	11	.335	[e]1,768.80	1.00
Clarksdale, Miss	Burnt clay	On road	300	12	....	.210	[f]1,478.40	1.25

[a] Includes $408.25 for culverts. [b] City and county prisoners used for labor; cost was for material only, at $2.15 per cubic yard. [c] Convict labor used. [d] Bricks from burned buildings were crushed and rolled for foundation; bowlders from fields were crushed and used for surfacing. [e] Novaculite from fields was used. [f] This was an experimental road.

Aided by appropriations of Congress, the office of Public Roads has been able to build object lesson roads in various sections of the country. The primary idea of the office is to investigate systems of road construction and maintenance and to spread information on the subject of road building. For this purpose a corps of highway engineers, expert road foremen, machinery operators for field duty, chemists, geologists and other experts, are maintained.

When a county or community desires to improve its roads, application can be made to the office of Public Roads. The applicants must provide: Right of way, all materials, common labor, teams and fuel, while the office furnishes engineering advice, surveys, estimates, expert supervision and road machinery. Also all materials used in construction are tested by the office. Owing to the large number of applications, it is never possible to comply with all requests for assistance in construction, but consideration is given to priority and to sections of the country that have had the least percentage of help so far as the location of the construction outfits will permit.

Advice as to less costly methods of construction, the use of local materials, and the testing of stone, gravel, brick and other materials, can always be obtained by following the rules of the office.

These object lesson roads, the first of which was built at the Cotton States Exposition in Atlanta, Ga., in 1895, have had a wonderfully beneficent effect in arousing the interest of the general public to road improvement. Communities that had never before had anything but muddy roads, have issued road bonds, after seeing an object lesson road constructed, and have spent thousands of dollars in road building and maintenance.

Naturally, the cost of this work varies exceedingly, but the cost per square yard gives a unit as a basis of comparison. Tables Nos. I and II show the recent work done by the Office of Public Roads, each table giving the essential details. The accompanying blank is used by the office for daily reports of work on the object lesson roads.

In 1904 there were 2,151,570 miles of public road in the United States.

At the end of 1904 Texas had 121,409 miles of public roads.

Germany has expended $150,000,000 during the past 20 years on the construction of canals and deepening river channels.

Table II.—Data in relation to object-lesson roads constructed in 1905-6

Place.	Materials used. Kind.	Miles from source.	Dimensions of road. Length.	Width.	Depth.	Area surfaced.	Cost Total cost.	Per square yard.	Rate per mile.	Cost of labor and teams per day. Men.	Teams.
			Feet.	Feet.	Inches.	Sq. yds.					
Coshocton, Ohio	Gravel, sand, and limestone	1.38	4,335	9-15	10	5,891	$2,820.29	$0.48	$ 2,534.00 to 4,224.15	$1.60	$ 3.50
Auburn, Nebr	Limestone	.80	3,900	[a] 15	10	6,623					
Columbia, Mo	Limestone	Local	5,253	16	6	9,339	9,416.07	1.42	[b]12,496.00	1.50	3.00
Macon, Mo	Limestone	Local	3,700	14	8	5,756	5,094.28	.54	5,120.44	1.50	3.00
Pullman, Wash	Basalt	Local	1,338	14	6	2,081	3,229.16	.561	4,607.67	1.50	3.00
Texarkana, Ark	Chert	2.00	3,334	12	7	4,445	2,438.50	1.17	9,600.00	2.50	4.50
	Gravel	.50					2,968.99	.668	4,702.02	1.50	3.50
San Antonio, Tex	Limestone	2.25	1,469	27.4	6	4,478	4,398.57	.981	[c]15,711.70	1.50	3.00
Lafayette, La	Clam and Oyster shells	.75	600	14	6	982	383.50	.39	3,200.00	1.25	3.00
Snow Hill, Ala	Limestone	.50	4,446	12	6	5,928	2,465.53	.41	2,886.40	.75	2.25
Uniontown, Ala	Limestone	5.00	5,500	12-14	6	7,684	2,677.06	.35	2,460.00 to 2,874.00	1.00	3.50
	Chert and slag	175.00									
Abbeville, S. C	Gravel and Chert	2.50	1,070	18-24	6	4,473	496.00	.11	1,419.73	[d].75	[e]2.50
Union, S. C	Granite	2.00	1,602	32-40	8	6,893	1,671.42	.242	5,494 37	.75	[f]2.50
Kenansville, S. C	Sand - clay	.20	5,900	20	6	13,111	440.35	.033	378.18	.80	2.25
Kinston, N. C	Sand - clay	Local	600	16	6	1,066.6	31.45	.03	276.92	[g]1.00	2.50
Newbern, N. C	Sand - clay	Local	800	12	3	1,066.6	28.86	.027	190.00	....	....
Washington, N. C	Sand - clay	Local	2,700	14	6	4,200	375.50	.09	739.13	1.00	2.50
Mount Weather, Va	Hornblende-schist	.20	2,047	15-18	6	4,783	[h]2,629.81	.56	5,913.60	1.50	3.50

[a] Including curb 10 in. wide and 12 in. deep, built to protect road from floods. [b] Cost more than usual, on account of curb, extra depth of material, and other extras; road entirely submerged by floods for seven days during construction. [c] A great deal of rain and very hot weather prevailed, which made it expensive to prepare to subgrade of "black gumbo" soil; this work was located on a city street, but the cost of curbs, together with the cost of lowering water and gas mains and making sewer connections, has been omitted, so that the cost may be compared with the cost of country roads. [d] Convict labor used; price paid for subsistence was $0.30 per day. [e] Traction engine used for hauling surfacing material; cost per day, $5.50. [f] Traction engine used for hauling stone; cost per day $5.00. [g] Twenty-three convicts were employed on this work, at $0.75 per day. [h] Cost of curbs, catch-basins, and brick-paved gutters has been omitted, in order that the cost may be compared with that of country roads.

Report of Advisory Board of Engineers on the Ashokan Reservoir Contract.

On November 12 Mayor McClellan of New York City made public the findings of the experts on the awarding of the Ashokan Reservoir contract to other than the lowest bidder, together with a report sent to him by Commissioners of Accounts Mitchel and Gaynor. The Mayor directed the Commissioners to make an investigation two months ago. Their engineer, Otto H. Klein, worked on it several weeks, reporting that he had gone far enough to convince him that the entire matter should be probed. At his suggestion the three experts were employed, and they began their work about three weeks ago.

This advisory board of engineers consisted of Colonel Thomas W. Symons, Eng. Corps U. S. Army and member of Advisory Board on the New York State Barge Canal; Halbert P. Gillette, managing editor ENGINEERING-CONTRACTING; Daniel J. Hauer, associate-editor ENGINEERING-CONTRACTING; Otto H. Klein, engineer Commissioners of Accounts.

This board was directed by Commissioners Mitchel and Gaynor to confine their inquiry to these points:

Whether the bid of John Peirce was such as to permit him to execute the contract satisfactorily; whether the bid of MacArthur Brothers and the Winston Company was fair or excessive; what action the commission should have taken, and whether Chief Engineer Waldo Smith's estimate of the cost of the work was correct.

The bid of the John Peirce Co. was $10,315,350, and was rejected as being too low, the contract being awarded to MacArthur Bros. Co. and Winston & Co., at their bid of $12,669,775.

"This board of advising engineers," writes the Mayor's experts, "is unanimous in its belief that the contract should have been awarded to the John Peirce Company at its bid of $10,315,350, as it believes after a careful study of it, that this bid was well considered and fairly well balanced and would have covered the cost of the work, allowed for its vigorous prosecution and permitted a fair margin of profit, if the work were carried on with proper plans, methods and administrative skill.

"In the Board of Advising Engineers' opinion the prices named in the bid of the John Peirce Co. for excavation and embankment are not too low to enable efficient work to be done at a profit; and, that even if the contractors were doing this work at no profit or at a loss the engineering department could be safely depended on to see that the work was done properly and well. So to this question, the Board of Advising Engineers begs to say that in its opinion the risk mentioned in the question could have been safely taken by the city."

Mayor McClellan has ordered a public investigation to be made of the awarding of this contract during the week of November 18, when the Board of Water Supply and their engineers will be given an opportunity to make public their position in the matter.

UNITED STATES DEPARTMENT OF AGRICULTURE.
OFFICE OF PUBLIC ROADS.
Daily report of work on Object-Lesson road at. . . . . .Date:. . . . .
Weather:. . . . . .Length of working day:. . . . . . . .hours. Signature:. . . . .

Force Employed.

	Total in hours or days.	Pay per hour or day.	Total.
Foremen			
Subforemen on			
Excavation: Men			
Teams			
Shaping: Men			
Teams			
Quarry: Men			
Teams			
Crusher: Men			
Engine and engineer			
Hauling surfacing material: To crusher			
To road			
Loading surfacing material at			
Spreading surfacing material			
Steam or horse roller			
Sprinkler			
. . . . .masonry			
Shoulder drains			
. . . . .drains			
Water boy			
Watchman			
Total			

Work Done.

Earth excavation	. . .cu. yds.	Sta. . to Sta. .
Subgrade shaped	. . .sq. yds.	Sta. . to Sta. .
First course placed	. . .sq. yds.	Sta . to Sta. .
Second course placed	. . .sq. yds.	Sta . to Sta .
Surface course placed	. . .sq. yds.	Sta. . to Sta. .
Road surface completed	. . .sq. yds.	Sta. . to Sta. .
Material crushed		

Materials Used, Paid for by Unit Measure.

	Quantity.	Price.	Total.
Surfacing material			
Fuel for crusher			
Fuel for roller			
Oil, waste, repairs			
Drain pipe, sizes			
Cement			
Total			

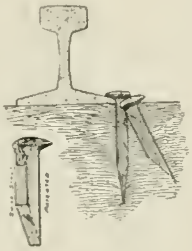
Remarks:. . . . .

Form Used by U. S. Office of Public Roads for Daily Report on Object Lesson Roads.

(Blank is 10½ ins. high by 8 ins. wide.)

The Spike Strut Rail Fastener.

With the increasing weight of railroad rolling stock and the remarkable increase of traffic, comes a demand for better methods of holding the rail rigidly to the tie, both on curves and straight track. In many instances this has been attempted by "double spiking." That is, instead of driving only one spike each side of the rail in each tie, two are driven. With nothing to lock the spike and hold it there, this method has not always been successful, especially with ties of some of the softer woods. To hold the rail fast to the tie, the "spike strut" has been invented. This arrangement is shown in the accompanying figure.



It consists of a special spike or strut beveled on the point, so it will assume the position shown when driven. The track spike is locked in a slot in the strut which holds it, and binds it against the rail. The strut is first driven a little way from the bottom flange of the rail and left standing above the tie an inch or more. Then the spike is driven down in between the rail and the strut, and in driving the spike home the strut is taken with it. This device is manufactured by the Maryland Railway Supply Co., Continental Bldg., Baltimore, Md.

The Sinola & Sonora Irrigation Co., of Mexico, has completed its canal which will conduct water from the Yaqui River to irrigate nearly 500,000 acres of land. The canal is 40 miles long, 54 ft. across the top, 35 ft. across the bottom and carries a volume of water 9 ft. in depth. In passing from the level of the river bed to the level of the lands covered, the canal traverses a tunnel cut in rock a distance of several hundred feet.

Methods and Costs; Some Old; Some New.

Cost of Ornamental Terra Cotta Work.—In the construction of the new U. S. Government printing office at Washington, completed in 1903, 19,100 cu. ft. or 585 tons of ornamental terra cotta was used. All of the ornamental terra cotta was filled solid with concrete and where it projected considerably, as in the main cornice, it was thoroughly tied back with steel anchors. The ornamental terra cotta used was built up of relatively thin webs, like hollow tiles, except that it was built up by hand instead of by being forced through a die. The total cost of the work was as follows; the price given for materials, however, does not include brick or concrete filling:

	Per cu. ft.	Per ton.
Handling	$0.0332	$1.0881
Setting	.1301	4.2513
Cement, etc.	.0243	.7944
Anchors, etc.	.0245	.8010
Total cost of setting	$0.2121	$6.9348
Average price for materials	1.5300	50.0000
Grand total	$1.7421	$56.9348

Some of the wages paid per 8-hour day during the construction of the building were as follows: Laborers, $1.50; brick layers, $4 to $4.50.

Moving a Bridge.—The following method of moving the superstructure of a new bridge into place on its substructure was employed by the Youngstown Construction Co., of New York. The bridge was a ballast top plate girder bridge of two spans of 50 ft. each and weighed with ballast top nearly 1,200 tons. It was erected at Newark, O., for the Baltimore & Ohio R. R., to replace an old structure weighing about 300 tons. The new bridge was built on falsework parallel to the old structure. About 75 yards distant and almost parallel with the B. & O. R. R. bridge was a bridge of the Pennsylvania R. R. having massive piers, and to these piers were attached blocks and lines for moving the new bridge into place. Four lines were used, one for each end of each span, the lines being carried to the spools of two hoisting engines. Between the new and the old structure pieces of wood were placed so that the new bridge as it moved would push the old one out on falsework provided to receive it. Both bridges rolled on steel rollers which turned between steel rails. The bridge was moved into position in three minutes. The work was done under the supervision of Harry A. Moore, Superintendent of Construction. For the above information we are indebted to E. S. Holloway, Newark, O.

Straightening a Chimney.—The foundation of a brick chimney, 84 ft. high and weighing about 140 tons, settled, throwing the top of the chimney about 3 ft. out of plumb. The chimney was about 8 ft. square at the base and was bonded to the brick wall of a power house. The base of the chimney rested on a 10-ft. square rubble masonry foundation, carried down 8 ft. to soft blue clay. To straighten the chimney and prevent future settlement it was decided to lift the outer edge and to permanently transfer part of the weight to new pile foundations. Accordingly a row of five piles were driven, inside the building, across the base of the chimney, the limited space necessitating the use of a hammer guided by special 8-in. leads braced to the power house boilers and the wall. A similar row of piles was driven on the opposite side of the chimney, and both rows capped with hard pine timbers about 2½ ft. below the ground level. Four 20-in. I beams 14 ft. long were inserted in holes cut through the boiler room and the opposite side of the wall, care being taken that the two middle beams should support the separate lining of the chimney. These I-beams supported on their upper flanges pairs of old steel rails in the thicknesses of the wall. A temporary distributing beam was carefully imbedded in a recess cut in the old masonry foundation and the I-beams brought to a bearing on it. The opposite ends of the I-beams rested on another temporary beam, which was supported by jackscrews set on the capping of the outer row of piles. By means of these jacks the outer edge of the chimney was raised until it was plumb. Mortar was then rammed into the space between the top of the old rubble foundation and the brickwork, grouted and allowed to set for two days. The temporary beams and the jacks were removed and the trenches over the pile tops filled with concrete in which old steel rails were bedded parallel to the power house wall for bearings for the steel I-beams which were left in the chimney.

Excavating Under a Conduit.—In the construction of a building foundation, the general excavation was carried down to a depth of about 10 ft., while the main foundation trenches were carried down to a depth of 20 to 24 ft. The excavation was carried on in a very loose, friable material, full of water, and absolutely lacking in stability, when free to escape laterally. On one side of the site was a conduit, semi-circular in section with a radius of about 3 ft., used in carrying steam pipes and cables. The conduit was in a street where there was heavy traffic and its highest part was about 18 ins. below the street level. It was necessary to carry the foundation trenches down about 16 ft. underneath the conduit and a little farther than its axial line. The following method was used to do this and to prevent any movement of the conduit or caving of the street under traffic: A series of inclined shores were put in, braced against posts set well inside the limits of the trench, and holding the conduit against any horizontal movement into the excavation. At intervals of about 12 ft. heading trenches 3 ft. wide were cut in at right angles to the conduit. The sides of these trenches were retained by means of boards and cross braces. The bottoms of the trenches sloped downward, so as to reach the bottom of the new foundations at the outer limit of the foundation trench, a little beyond the axis of the conduit. One trench was opened at a time, and as soon as possible two pieces of 6x6-in. timber were set up at the end of the heading trench. The timber rested on mud sills at the level of the new foundation, and at their upper ends wedges were driven tightly between the uprights and the bottom of the conduit. Pieces of 2x3-in. timber had been nailed on each side of each upright at its front edge to serve as guides for pieces of plank used like horizontal flashboards. These pieces stopped off far enough from the upper ends of the uprights to permit of putting in the pieces of plank from the top. As soon as possible after the completion of the heading trench, the plank casing was put in and earth rammed in behind it, so as to have a fair bearing against the bank. The next heading trench was then completed in the same way. Then at a point midway between the two trenches, a third heading trench was dug, but only a single upright was placed in it. As soon as it was placed the earth between the middle trench and the two others were taken out, the casing boards being put in as the excavation progressed, and all caving behind them immediately repaired by fresh earth thrown in and rammed. In this way the conduit was held absolutely in place. When the foundations were put in, a 13-in. concrete wall was built up against the casing under the conduit, the idea being that this wall should carry the weight of the conduit after the timbers had rotted out. The space between the wall and the main foundations was then filled with sand, well rammed and settled with water.

The Building Committee of the Board of Trustees of the University of Alabama, has authorized the construction of a new engineering laboratory for that institution and contracts will shortly be let for its erection. Contracts will be made for equipment as rapidly as details can be worked out. The laboratories for Mining, Electrical, Mechanical and Civil Engineering are all to be grouped about a central power station and will be equipped with tracks, cranes, and all appliances and testing machines necessary for physical testing on a commercial scale. The building will be of steel mill construction with light colored brick walls and concrete or stone trimmings.

The Cost of Building Forty Hand-Car Houses.

In this article we give the cost in detail of erecting 40 frame hand-car houses on a division of a western railroad. The price of lumber is given and other materials, as well as the labor costs. The work was done by "company men." Summary of the work is given so as to allow of easy comparison with costs of other cheap structures previously given in this series of articles*.

Forty hand-car houses built on one division: size 8x12 ft.; area 96 sq. ft.

Weight:	Pounds.
48,055 ft. B M at 3,300 lbs	158,581
50 M shingles at 150	7,500
Hardware and paint	2,400
Total 84 tons	168,481

Timber:	
9,207 ft. B. M. at $11.50	$105.88
6,400 ft. B. M. at $11.50	73.60
1,200 ft. B. M. S. 1 S. at $13.75	16.50
4,053 ft. B. M. S. 1 S. at $28.75	116.52
3,407 ft. B. M. at $19.00	64.73
1,760 ft. B. M. at $19.00	33.44
2,333 ft. B. M. ceiling at $32.50	75.82
2,725 ft. B. M. S. 1 S. at $14.00	38.15
2,270 ft. B. M. S. 1 S. at $28.75	65.26
8,500 ft. B. M. S. 1 S. at $28.75	244.33
6,200 ft. B. M. at $13.00	80.60
48,055 ft. B. M. total at $19.03 (av.)	$914.83
50 M shingles at $1.25	62.50

Hardware:	
80 pairs 12 in hinges, $1.21 per doz.	$ 8.06
80 5 in. hasp and staples	1.20
140 doz. 1¾ in. screws at $0.23½ per gross	2.74
27 doz. ⅞ in. screws at $0.08 per gross	.18
200 lbs. 3d nails at $2.85	5.70
100 lbs. 6d nails at $2.25	2.25
200 lbs. 16d nails at $2.00	4.00
40 8 in. hinge hasps	1.25
40 padlocks	9.00
250 lbs. 20d nails at $2.00	5.00
800 lbs. 10d nails at $2.05	16.40
Total	$55.78
100 gals. railroad paint at $0.75	$ 75.00

Labor:	
Superintendent	$ 23.73
Foreman, 29 days at $3.00	87.00
Carpenters, 121.5 days at $2.50	303.75
Total	$414.48
Tools	$3.75

For one hand-car house, weighing 2.1 we give the following summary:

Materials:		Per Ct.
1,201 ft. B. M. at $19.03	$22.87	60.0
1¼ M shingles at $1.25	1.56	4.1
Hardware	1.39	3.7
Paint	1.87	4.9
Total materials	$27.69	72.7
Labor	$10 36	27.1
Total materials and labor	$38.05	99.8
Tools	$ .09	0.2
Grand total	$38.14	100.0

	Cost per sq.ft.	Per Ct.
Materials	$0.288	72.7
Labor	0.108	27.1
Tools	0.001	0.2
Total	$0.397	100.0

The cost per M ft. B. M. for the entire labor on these buildings was $8.62, which was quite low.

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*See Engineering-Contracting, Aug. 28, Sept. 11, Oct. 9, Oct. 30 and Nov. 6.

Traffic Records on Selected Streets of New York City.

BY J. W. HOWARD.*

During the examination made by the Commissioners of Accounts of New York city of the administration of the pavements, etc., of Manhattan, and subsequent investigation by Governor Charles E. Hughes of New York state, it became necessary to know the quantity of traffic on representative avenues and streets. I was employed as Consulting Engineer on Pavements, and among other matters recorded and reported to the Governor the traffic on several streets and showed its relation to the maintenance or neglect of the pavements. The heavy traffic streets in wealthy and influential districts as 5th Ave., are maintained in good order, whereas, the lighter traffic streets in poor districts have not been kept in repair. Traffic records have heretofore been made for 10, 11 or 12 daylight hours. Therefore for purposes of comparison with previous traffic, I made records for 11 daylight hours on various streets. The heaviest traffic recorded in New York for 11 hours was on Oct. 14, 1907. It was 11,170 vehicles weighing about 13,360 tons on 5th Ave. between 33d and 34th Sts., or 279 vehicles, or 324 tons, per foot of width of roadway for 11 hours. The traffic on 1st Ave. between 26th and 27th Sts. for 11 hours on the same date was 4,445 vehicles weighing about 6,734 tons, which was about 79 vehicles or 120 tons per foot of width of roadway for 11 hours.

The following tables show the traffic on 5th and 1st Aves. for 24 consecutive hours. This is probably the first time that traffic for 24 hours has been recorded in any American city. The table given below shows the number of vehicles on 5th Ave., New York, in 24 hours, between 58th and 59th Sts., going north and south, from Wednesday noon, Oct. 9, to Thursday noon, Oct. 10, 1907:

Hours.	Horse Vehicles, average weight with load.			Total Horse Vehicles.	Automobiles, average weight, 1 ton.	Total Vehicles.
	1 ton.	2 tons.	4 tons.			
12-1	437	69	30	536	230	766
1-2	421	107	20	548	184	732
2-3	296	60	11	367	142	509
3-4	583	86	24	693	331	1024
4-5	661	88	17	766	400	1166
5-6	537	42	9	588	329	917
6-7	484	46	1	531	275	806
7-8	156	60	3	219	115	334
8-9	165	37	3	205	54	259
9-10	122	12	0	134	75	209
10-11	119	9	0	128	70	198
11-12	117	13	0	130	71	201
Midni't	....	....	....	...	...	.
12-1	85	27	0	112	45	157
1-2	40	8	0	48	20	68
2-3	14	6	2	22	5	27
3-4	21	2	3	26	4	30
4-5	33	14	6	53	3	56
5-6	27	19	24	70	0	70
6-7	42	44	2	88	19	107
7-8	122	57	12	191	31	222
8-9	211	53	6	270	187	457
9-10	263	51	19	333	179	512
10-11	437	51	17	505	308	813
11-12	432	65	10	507	232	739
Totals.	5825	1026	219	7010	3309	10379

The estimated weight of 5th Ave. vehicles and loads was 12,062 tons. The width of 5th Ave. at the place of recording this traffic is 41 1/3 ft. There were, therefore, 251 vehicles, or 292 tons, per foot of width per 24 hours. This can be regarded as an average week day traffic on 5th Ave. between 9th and 59th Sts. The Sunday traffic on 5th Ave. is about one-fifth the week day traffic.

The following table shows the number of vehicles on 1st Ave., New York, in 24 hours, between 77th and 78th Sts., going north and south, from Wednesday noon, Oct. 9, to Thursday noon, Oct. 10, 1907:

Hours.	Horse Vehicles, average weight with load.			Total Horse Vehicles.	Automobiles, average weight, 1 ton.	Total Vehicles.
	1 ton.	2 tons.	4 tons.			
12-1	96	44	3	143	1	144
1-2	165	45	6	216	0	216
2-3	183	60	13	256	3	259
3-4	149	73	9	231	3	234
4-5	108	80	7	195	0	195
5-6	104	91	4	199	2	201
6-7	83	42	2	127	1	128
7-8	41	22	1	64	0	64
8-9	33	11	0	44	0	44
9-10	19	7	0	26	0	26
10-11	3	5	0	8	0	8
11-12	3	3	1	7	0	7
Midni't	..		....	..	....	......
12-1	0	0	0	0	0	0
1-2	1	0	0	1	0	1
2-3	4	2	2	8	0	8
3-4	14	10	1	25	0	25
4-5	16	5	1	22	0	22
5-6	45	10	1	56	0	56
6-7	58	41	4	103	0	103
7-8	95	24	12	131	1	132
8-9	102	58	20	180	0	180
9-10	134	52	23	209	1	210
10-11	129	71	20	220	3	223
11-12	116	48	13	177	2	179
Totals.	1701	804	142	2648	17	2665

The estimated weight of 1st Ave. vehicles and loads was 3,898 tons. The width of 1st Ave. at the place of recording this traffic is 56 ft. There were therefore 48 vehicles or 69 2-3 tons per foot of width per 24 hours. This can be regarded as an average week day traffic on 1st Ave. between 22d and 109th Sts. The Sunday traffic on 1st Ave. is very small; sometimes none is in sight for an hour or more.

Fifth Ave., New York, has probably the largest, if not the heaviest, traffic in total quantity, as well as per foot of width, found in any American city. It is exceeded by a few streets in Paris, London and Berlin. It is interesting to notes the large proportion of automobiles now in use.

Records of street traffic help solve the paving problems of cities and should be made at reasonable intervals in every important city. The flow of traffic needs controlling, guiding and relief, not only on account of pavements but for other obvious reasons.

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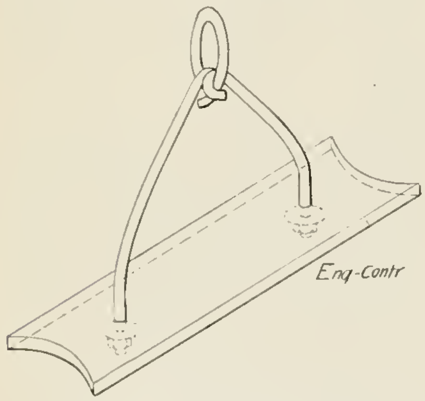
*Consulting Engineer on Pavements, 1 Broadway, New York City.

The Spanish Navy Reform Commission has recommended a total appropriation of $39,730,800, which includes funds for the construction of three 15,000-ton battleships, three torpedo boat destroyers or submarine boats, 24 torpedo boats and a number of service ships.

A Device for Lining Up Piles Before Capping Them.

In driving piles for trestles, especially where they are long and the ground is full of gravel or boulders, the piles slew to one side or the other, and before they can be sawed off and capped, so the deck or top driver can be moved ahead, they must be pulled into place and properly lined up with the other bents. An ingenious contrivance is illustrated in cut below to assist in doing this work. This separator will hold the piles apart, without slipping, when the whole bent can be pulled into place with ropes. The separator is easily made by any blacksmith. A piece of iron plate from ¾ in. to 1 in. thick and from 10 to 12 ins. wide is cut to the shape shown in cut. Two holes are drilled through the plate, and either two rods or chains are thus fastened to it, meeting at the top in a large ring.

To operate the separator the pile line is fastened to the ring and the tool is lowered between two piles, when by means of the engine a strain is put on the pile line pulling the separator up between the piles and parting them until they measure the correct centers. One separator is placed between each two piles that have gotten too close in driving. They are kept in place until the cap is drift bolted, when a few taps with a sledge will loosen the separator. From four to six of these tools should be made and kept on the driver and it is well to have them of several different lengths, as time is thus saved in pulling them between the piles.



Device for Lining up Piles.

There are at the present time 22 railroad companies established in the Argentine Republic, of which 18 are English, with head offices in London, 1 a French company, and 3 are owned and operated by the Argentine government. The majority of the roads—19,347 kilometers—are single track, and only 446 kilometers are double track Three different gages are used on these lines, namely, 1 meter, 1.435 meter, and 1.676 meter. Eight lines, with 12,444 kilometers, use the last; four, with 1,806 kilometers, the medium; and ten, with 5,542 kilometers, the narrowest gage.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write direct to the advertisers and state that you saw the catalog mentioned in *Engineering-Contracting*. If you are in the market for tools, machinery or supplies tell us and we will notify promptly the leading manufacturers.

No. 0454. **Nye Steam Pump.**—Nye Steam Pump & Machinery Co., Chicago, Ill.

The pump described in this 38-page pamphlet is a pump of the vacuum type for use in draining pits, quarries and mines and for general pumping purposes. Illustrations and descriptions of operation are given, with letters from users.

No. 0455. **Special Hand Shovels.**—The Conneaut Shovel Co., Conneaut, Ohio.

This eight-page catalog is the best one on the subject we have ever seen. It tells the origin of the Ronberg shovels, and explains how the shovel manufacturing company began the idea of making shovels to suit each class of shoveling. A special designed shovel for each class of work, and not one shape of shovel for all work, is the outcome of their policy. It is found that men will do more work with less exertion by having such shovels. Ten different kinds of shovels are illustrated and the company employs experts to design shovels to suit any special work.

No. 0456. **Engines.**—A. B. Farquhar Co., Ltd., York, Pa.

This catalog illustrates traction engines, stationary engines, portable engines and boilers, upright boilers, and boilers mounted on wheels for contractor's use. It also shows saw mills and saw mill supplies and saws.

No. 0457. **Test Hole Drilling.**—The Cyclone Drill Co., Orrville, Ohio.

This catalog explains the system of drilling with hollow rods, by the hydraulic or jetting process. Various types and sizes of drills are illustrated and tools of all descriptions for prospecting drilling are shown. The catalog is a new one of about 100 pages, gotten up in attractive style.

No. 0458. **Expanded Metal Reinforcement for Bridges.**—Northwestern Expanded Metal Co., 935 Old Colony Building, Chicago, Ill.

This 32-page pamphlet shows designs of arch and girder bridges of concrete reinforced with expanded metal, and explains the merits of this type of reinforcement and of reinforced concrete bridges for highway and street work. The idea is to give officials a series of designs from which they can choose one suitable to their purpose and by writing to the company secure estimates, plans, etc., for construction. The pamphlet also gives designs for sewers of various sections.

No. 0459. **Hand Power Bridge Cranes.**—Tuohy Brothers, New York, N. Y.

The cranes illustrated in this 32-page pamphlet are made by the well known Reading Crane & Hoist Works and are designed for hand power. Traveling bridge cranes of various types are shown with tables of dimensions, capacities, etc. These cranes are all equipped with multiple gear combined hoist and trolley for which special efficiency is claimed.

No. 0460. **Gas Engines.**—Williamsport Gas Engine Co., Williamsport, Pa.

This 14-page pamphlet gives a good description of the construction of the gas engine made by the firm named above. Both stationary and portable engines are made. There is a brief discussion of the comparative advantages of steam and gas engines.

No. 0461. **Holman Tracklayer.**—D. F. Holman Railway Tracklayer Co., 1103 Ellsworth Building, Chicago, Ill.

The Holman tracklaying machine is too well known to most railway men to need description, but those who are not familiar with the machine and its operation will find both described in this 24-page pamphlet with useful tables, names of users and letters of appreciation from engineers and contractors.

No. 0462. **Track Drills and Drill Grinders.** Cook's Standard Tool Co., Kalamazoo, Mich.

This 16-page pamphlet illustrates and describes a portable rail drill for which several merits are claimed and particularly a portable grinder for twist drills which should be capable of use in many places besides railway track work. This grinder is fitted with an attachment which holds the drill in exactly the proper position for grinding and is a most ingenious and simple device for its purpose. Contractors using twist drills should secure this pamphlet and read the description of this grinder and its operation.

No. 0463. **Contractor's Lights.**—The Bolte & Weyer Co., 223 Michigan St., Chicago, Ill.

The light described in this circular is a two lantern gasoline light self-contained and weighing 80 lbs. It is claimed to light a 100 ft. square and to burn for 5 hours with 1 gallon of gasoline.

No. 0464. **Jacks.**—The Buda Foundry & Mfg. Co., Chicago, Ill.

The line of jacks described in this 72-page catalog comprises ball and cone bearing jacks, ratchet, geared ratchet and ratchet and friction jacks of all sizes for railway and industrial purposes. Each style of jack is described and shown by sectional drawings and there are tables of sizes, dimensions, duplicate parts, etc. The jack user should have the catalog on file.

Personals.

C. W. Sanders, Chief Engineer of the Copper Range R. R., died Nov. 4, at Houghton, Mich.

Mr. Albert Decker, Jr., has been appointed to the position of Assistant Engineer, Bureau of Sewers of Queens Borough, New York City.

Messrs. E. R. Kerby, J. N. Mayfield and W. L. C. Shaw have organized the Kerby-Shaw Engineering & Construction Co., of Lawton, Okla.

Jurisdiction of Mr. George W. Boschke, Chief Engineer of Oregon R. R. & Navigation Co., has been extended to cover the Corvallis & Eastern R. R.

Mr. F. H. Cothran has been appointed Chief Engineer of the Bristol & Kingsport Ry. Co., which proposes to construct a line from Bristol, Tenn., to Kingsport, Tenn.

Mr. W. C. Shaw, Jr., has been appointed Chief Engineer of the Georgia Southern & Florida Ry., with headquarters at Macon, Ga., to succeed Mr. G. B. Herrington, resigned.

Prof. George S. Beane, head of the Department of Electrical Engineering at the University of Southern California, Los Angeles, Cal., died suddenly Oct. 31, of heart failure.

Mr. J. E. Dougherty has been appointed Resident Engineer by the Commissioners of Sedgwick County, Kansas, to supervise the construction of the Douglas Ave. bridge at Wichita, Kan.

Jesse N. Searle, manager of the Northern and Eastern Districts of the Southern Ry., with headquarters at Washington, D. C., died Dec. 11, in that city, from the effects of a stroke of paralysis.

Frank H. Earle, senior member of the firm of Earle & Harrison, Civil Engineers, Jersey City, N. Y., died Nov. 7 at his home in Newark, N. J. Mr. Earle was President of the Raritan River R. R.

Mr. D. C. Wrighter of Lewiston, Idaho, has been appointed Constructing Engineer in charge of the construction of a seven mile lumber flume at Kamiah, Idaho, for the Kamiah Lumber & Flume Co.

Messrs. J. E. Young, J. W. O'Neal, J. H. Slaughter, S. W. Morrison and C. V. Morrison have organized the Moys Construction Co., of Wheeling, W. Va., and will engage in a general contracting business.

Aaron R. Thompson, at one time Superintendent of Section No. 6 of the Erie Canal, and later Commissioner of Public Works, of Syracuse, N. Y., died Nov. 14, at his home in that city from the effects of a stroke of paralysis.

Charles D. Wyman, former General Manager of the Milwaukee Electric Railway & Light Co., died Nov. 12, on a train in Montana. Mr. Wyman was prominently connected at different times with street railways in Boston and New Orleans.

Mr. J. F. Coleman has resigned his position as Chief Engineer of the New Orleans Great Northern R. R., now under construction. Mr. Coleman's resignation is to take effect Dec. 31. Mr. Coleman will probably be retained as Consulting Engineer for the road.

Mr. W. G. Wilgus, formerly Vice President of the New York Central & Hudson River R. R., has been retained as Consulting Engineer by the Detroit Tunnel Co., which is now engaged in tunneling under the Detroit River, between Detroit, Mich., and Sarnia, Ont. Mr. Wilgus was actively identified with the inception of this undertaking and the preparation of plans for it.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED

Bridges.

Nov. 20.	Georgetown, S. C.	Oct. 30
Nov. 20.	Graham, Tex.	Nov. 13
Nov. 21.	Knoxville, Tenn.	Nov. 20
Nov. 22.	South Bend, Ind.	Nov. 13
Nov. 22.	Big Fork, Minn.	Nov. 13
Nov. 23.	Fresno, Cal.	Nov. 13
Nov. 25.	Los Angeles, Cal.	Nov. 13
Nov. 25.	Jersey City, N. J.	Nov. 20
Nov. 25.	Newark, O.	Nov. 20
Nov. 25.	Oakland, Cal.	Nov. 20
Nov. 25.	Los Angeles, Cal.	Nov. 20
Nov. 29.	Cincinnati, O.	Nov. 13
Nov. 29.	Portland, Ore.	Nov. 6
Nov. 29.	Bethlehem, Pa.	Nov. 6
Nov. 29.	Spokane, Wash.	Nov. 20
Nov. 29.	Pottsville, Pa.	Nov. 20
Nov. 30.	Emporia, Kan.	Nov. 20
Dec. 3.	Paoli, Ind.	Nov. 20
Dec. 4.	Newport, Ind.	Nov. 20
Dec. 4.	Muncie, Ind.	Nov. 20
Dec. 10.	Jackson, Minn.	Nov. 20
Jan. 7.	Castle Haynes, N. C.	Nov. 20
Feb. 13.	St. Charles, Mo.	Oct. 30

Buildings.

Nov. 20.	Fort Monroe, Va.	Oct. 30
Nov. 20.	Runge, Tex.	Nov. 13
Nov. 20.	New York, N. Y.	Nov. 13
Nov. 20.	Phoenix, Ariz.	Nov. 13
Nov. 21.	New Orleans, La.	Oct. 9
Nov. 21.	Greenville, Tenn.	Oct. 23
Nov. 21.	Jersey City, N. J.	Nov. 20
Nov. 22.	Portsmouth, Va.	Oct. 23
Nov. 23.	Washington, D. C.	Nov. 20
Nov. 23.	Pine Bluff, Ark.	Nov. 20
Nov. 25.	Tyler, Tex.	Oct. 23
Nov. 25.	Chicago, Ill.	Nov. 20
Nov. 25.	Milwaukee, Wis.	Nov. 20
Nov. 26.	Danville, Pa.	Nov. 13
Nov. 26.	Milwaukee, Wis.	Nov. 20
Nov. 26.	Jersey City, N. J.	Nov. 20
Nov. 26.	New Roads, La.	Nov. 20
Nov. 27.	Fort Mackenzie, Wyo.	Nov. 6
Nov. 27.	Washington, D. C.	Nov. 6
Nov. 27.	Nashville, Tenn.	Nov. 13
Nov. 27.	New York, N. Y.	Nov. 20
Nov. 29.	Marion, Ind.	Oct. 30
Nov. 29.	New Albany, Ind.	Nov. 6
Nov. 29.	Oakmont, Pa.	Nov. 13
Nov. 29.	New Albany, Ind.	Nov. 13
Nov. 29.	Pottsville, Pa.	Nov. 20
Nov. 30.	Chicago, Ill.	Nov. 20
Dec. 2.	Devils Lake, N. Dak.	Nov. 6
Dec. 2.	North Chicago, Ill.	Nov. 13
Dec. 2.	Ely, Nev.	Nov. 13
Dec. 2.	Fort Worden, Wash.	Nov. 20
Dec. 3.	Nevada, Mo.	Oct. 30
Dec. 3.	Tempe, Ariz.	Nov. 13
Dec. 3.	Allentown, Pa.	Nov. 20
Dec. 5.	Waldoboro, Me.	Oct. 30
Dec. 7.	Remsen, N. Y.	Nov. 13
Dec. 9.	Wernersville, Pa.	Nov. 6
Dec. 9.	Los Angeles, Cal.	Nov. 20
Dec. 9.	Pulaski, Tenn.	Nov. 20
Dec. 9.	Chicago, Ill.	Nov. 20
Dec. 10.	Canton, S. Dak.	Nov. 13
Dec. 10.	Alpine, Tex.	Nov. 13
Dec. 10.	Mobile, Ala.	Nov. 13
Dec. 10.	Jacksonville, Fla.	Nov. 13
Dec. 12.	Whipple Barracks, Ariz.	Nov. 20
Dec. 17.	Detroit, Mich.	Nov. 6
Dec. 17.	Pawnee, Okla.	Nov. 13
Dec. 19.	Ocala, Fla.	Nov. 13
Dec. 23.	Ann Arbor, Mich.	Nov. 6
Dec. 30.	Lancaster, Pa.	Nov. 13
Jan. 2.	Flint, Mich.	Nov. 13
Jan. 2.	South Bend, Ind.	Nov. 20
Jan. 3.	Albuquerque, N. Mex.	Nov. 20

Roads and Streets.

Nov. 20.	Harrisburg, Pa.	Nov. 6
Nov. 20.	Des Moines, Ia.	Nov. 6
Nov. 20.	Hot Springs, Ark.	Nov. 6
Nov. 20.	Brooklyn, N. Y.	Nov. 13
Nov. 21.	Albany, N. Y.	Oct. 30
Nov. 21.	Harrisburg, Pa.	Nov. 6
Nov. 21.	Kansas City, Mo.	Nov. 13
Nov. 21.	Galveston, Tex.	Nov. 20
Nov. 22.	Harrisburg, Pa.	Nov. 6
Nov. 22.	Pittsburg, Pa.	Nov. 20
Nov. 22.	Pittsburg, Pa.	Nov. 20
Nov. 23.	Fort Myer, Va.	Nov. 13
Nov. 23.	Knox, Ind.	Nov. 13
Nov. 23.	Chicago, Ill.	Nov. 20
Nov. 25.	Columbia, S. C.	Oct. 30
Nov. 25.	Cincinnati, O.	Nov. 20
Nov. 25.	Milwaukee, Wis.	Nov. 20
Nov. 25.	Woodbury, N. J.	Nov. 20
Nov. 25.	Milwaukee, Wis.	Nov. 20
Nov. 25.	Scranton, Pa.	Nov. 20
Nov. 25.	Erie, Pa.	Nov. 20
Nov. 26.	Fort Flagler, Wash.	Nov. 6
Nov. 26.	Wilmington, Del.	Nov. 13
Nov. 26.	Vincennes, Ind.	Nov. 20
Nov. 27.	Kansas City, Mo.	Nov. 20
Nov. 27.	Ottawa, Ill.	Nov. 20
Nov. 29.	Logansport, Ind.	Nov. 6
Nov. 30.	Kansas City, Mo.	Nov. 20
Nov. 30.	Greencastle, Ind.	Nov. 20
Dec. 2.	Lebanon, Ind.	Nov. 13
Dec. 2.	Sullivan, Ind.	Nov. 20
Dec. 2.	Salem, Ind.	Nov. 20
Dec. 2.	Columbus, Ind.	Nov. 20
Dec. 3.	Monticello, Ind.	Nov. 6
Dec. 3.	Monticello, Ind.	Nov. 20
Dec. 4.	Logansport, Ind.	Nov. 20
Dec. 5.	Danville, Ind.	Nov. 20
Dec. 6.	Salt Lake City, Utah	Oct. 23
Dec. 7.	Peru, Ind.	Nov. 13
Dec. 10.	Lebanon, Ind.	Nov. 13
Dec. 12.	Flemington, N. J.	Nov. 20
Dec. 13.	Monticello, Ind.	Oct. 30
Dec. 14.	Lebanon, Ind.	Nov. 13

Sewers.

Nov. 20.	Springfield, O.	Nov. 6
Nov. 20.	Des Moines, Ia.	Nov. 6
Nov. 20.	Oakland, Cal.	Nov. 6
Nov. 20.	Reading, Pa.	Nov. 13
Nov. 20.	Brooklyn, N. Y.	Nov. 13
Nov. 20.	Richmond, Ind.	Nov. 13
Nov. 21.	Kansas City, Mo.	Nov. 13
Nov. 21.	Youngstown, O.	Nov. 13
Nov. 21.	Kingston, Pa.	Nov. 20
Nov. 21.	Dubuque, Ia.	Nov. 20
Nov. 22.	Newport, Pa.	Nov. 13
Nov. 22.	Kendallville, Ind.	Nov. 13
Nov. 22.	Pittsburg, Pa.	Nov. 20
Nov. 22.	Indianapolis, Ind.	Nov. 20
Nov. 23.	Des Moines, Ia.	Nov. 20
Nov. 23.	Allegheny, Pa.	Nov. 20
Nov. 25.	Canton, O.	Nov. 13
Nov. 25.	Fort Du Pont, Del.	Nov. 13
Nov. 25.	Erie, Pa.	Nov. 20
Nov. 25.	Jersey City, N. J.	Nov. 20
Nov. 25.	St. Paul, Minn.	Nov. 20
Nov. 25.	Washington, D. C.	Nov. 20
Nov. 25.	Cairo, Ill.	Nov. 20
Nov. 27.	White Plains, N. Y.	Nov. 13
Nov. 27.	Lafayette, Ind.	Nov. 20
Nov. 28.	Norfolk, Va.	Nov. 20
Dec. 2.	Cadillac, Mich.	Oct. 23
Dec. 3.	Auburn, N. Y.	Oct. 16
Dec. 4.	Des Moines, Ia.	Nov. 20
Dec. 6.	Salt Lake City, Utah	Nov. 6
Dec. 7.	Marcy, N. Y.	Nov. 20

Water Supply.

Nov. 21.	Santa Fe, N. Mex.	Nov. 6
Nov. 21.	Fort Stevens, Ore.	Nov. 20
Nov. 27.	Madison Barracks, N. Y.	Nov. 20
Nov. 28.	Fort Morgan, Ala.	Nov. 6
Dec. 1.	Phoenix, Ariz.	Oct. 16
Dec. 2.	Phoenix, Ariz.	Nov. 13
Dec. 12.	Cambridge Springs, Pa.	Nov. 20
Dec. 17.	Camden, N. J.	Oct. 16

Miscellaneous.

Nov. 20.	New Orleans, La.,	Dredge,	Oct. 2
Nov. 20.	Ludington, Mich.,	Breakwater,	Oct. 30
Nov. 20.	Baltimore, Md.,	Garbage Disposal,	Nov. 13
Nov. 21.	Galveston, Tex.,	Jetty Work,	Oct. 30
Nov. 21.	Austin, Tex.,	Concrete Wall,	Oct. 30
Nov. 21.	Fort Sumter, S. C.,	Wharf,	Oct. 30
Nov. 22.	Fort Adams, R. I.,	Coal Bin, Sea Wall, Etc.,	Nov. 13
Nov. 22.	Pittsburg, Pa.,	Boardwalks and Steps,	Nov. 20
Nov. 22.	Governor's Island, N. Y. H.,	Vessel Repairs,	Nov. 20
Nov. 23.	Las Animas, Colo.,	Power Plant,	Nov. 13
Nov. 25.	Mobile, Ala.,	Locks and Dams,	Oct. 2
Nov. 25.	Pittsburg, Pa.,	Monument,	Nov. 13
Nov. 25.	Columbus, O.,	Tunnel, Boiler Foundations,	Nov. 20
Nov. 26.	Ottawa, Ont.,	Wharf,	Nov. 20
Nov. 26.	Chicago, Ill.,	Iron Plate Floor,	Nov. 20
Nov. 26.	Durhamville, N. Y.,	Aqueduct,	Nov. 20
Nov. 27.	Washington, D. C.,	Steamers,	Nov. 13
Nov. 27.	New York, N. Y.,	Building Scows,	Nov. 20
Nov. 29.	New York, N. Y.,	Snow and Ice Removal,	Nov. 20
Nov. 29.	Brooklyn, N. Y.,	Snow and Ice Removal,	Nov. 20
Nov. 30.	Fort Caswell, N. C.,	Bulkhead,	Nov. 13
Nov. 30.	Bloomsburg, Pa.,	Monument,	Nov. 13
Dec. 2.	Washington, D. C.,	Tow Boat,	Nov. 13
Dec. 2.	Meaford, Ont.,	Breakwater, Etc.,	Nov. 13
Dec. 3.	Reading, Pa.,	Garbage Disposal,	Nov. 20
Dec. 4.	Altoona, Pa.,	Garbage Disposal,	Nov. 6
Dec. 4.	Danville, Ill.,	Telephone System,	Nov. 20
Dec. 18.	Madison, Wis.,	Concrete Work, Wrecking,	Nov. 13
Dec. 20.	Portland, Ore.,	Steamboat,	Nov. 20
Dec. 21.	Chinook, Mont.,	Electric Light Works,	Nov. 20
May 1.	Buenos Aires, Argentina,	Subways,	Nov. 20

Excavation, Earth and Rock.

Nov. 20.	Detroit, Mich.,	Dredging,	Oct. 16
Nov. 20.	Grand Rapids, Mich.,	Dredging,	Oct. 30
Nov. 21.	Galveston, Tex.,	Dredging,	Oct. 30
Nov. 21.	Mobile, Ala.,	Dredging,	Oct. 30
Nov. 22.	Newport, R. I.,	Dredging,	Oct. 30
Nov. 23.	Pesotum, Ill.,	Tile Drain,	Nov. 13
Nov. 23.	Hartford City, Ind.,	Ditch,	Nov. 13
Nov. 23.	Decatur, Ind.,	Ditch,	Nov. 20
Nov. 25.	Memphis, Tenn.,	Levee and Ditch,	Oct. 30
Nov. 25.	New York, N. Y.,	Dredging,	Oct. 30
Nov. 27.	Anderson, Ind.,	Ditch,	Nov. 20
Dec. 2.	Trenton, Ont.,	Railroad Work,	Nov. 13
Dec. 3.	Wheaton, Minn.,	Ditch,	Nov. 20
Dec. 3.	Wausau, Wis.,	Drainage Ditches,	Nov. 6
Dec. 6.	Canton, N. Y.,	Ditch Work,	Nov. 13
Dec. 11.	Emmetsburg, Ia.,	Ditch Work,	Nov. 20

Materials, Machines, Supplies, Tools, Etc.

Nov. 21.	Philadelphia, Pa.,	Machinery,	Nov. 20
Nov. 21.	Avalon, Pa.,	Fire Hose,	Nov. 20
Nov. 22.	Madison, Wis.,	Boilers, Engines, Etc.,	Nov. 20
Nov. 22.	Tipton, Ind.,	Water Heater,	Nov. 20
Nov. 23.	New Orleans, La.,	Elevator,	Nov. 6
Nov. 25.	Atlanta, Ga.,	Pump, Pipe, Engine,	Oct. 30
Nov. 25.	Cincinnati, O.,	Water Meters,	Nov. 20
Nov. 25.	Pittsburg, Pa.,	Gas Engines, Pipe,	Nov. 20
Nov. 25.	Jersey City, N. J.,	Gate Boxes, Covers, Etc.,	Nov. 20
Nov. 25.	Jersey City, N. J.,	Special Castings,	Nov. 20
Nov. 26.	Atlanta, Ga.,	Boiler,	Nov. 20
Nov. 27.	Washington, D. C.,	Clock System,	Nov. 6
Nov. 20.	New York, N. Y.,	Fire Hose,	Nov. 13
Nov. 20.	Sonyea, N. Y.,	Boilers,	Nov. 13
Nov. 26.	Providence, R. I.,	Elevator Equipment,	Nov. 13
Dec. 1.	Phoenix, Ariz.,	Water Pipe,	Oct. 16
Dec. 2.	Vicksburg, Miss.,	Road Outfit,	Nov. 13
Dec. 3.	Hollidaysburg, Pa.,	Water Pipe,	Nov. 20

Dec. 4. Minerva, O.,
Boiler, Nov. 20
Dec. 6. Washington, D. C.,
Pumps, Blocks, Rope, Etc., Nov. 13
Dec. 13. Washington, D. C.,
Lumber, Angles, Etc., Nov. 20
Dec. 14. Nashville, Tenn.,
Lumber, Nov. 20
Jan. 15. Manila, P. I.,
Pumps and Motors, Oct. 30
Dec. 16. Tompkinsville, N. Y.,
Lanterns, Nov. 20

BIDS ASKED

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Los Angeles, Cal.—Until 2 p. m., Nov. 25, by C. G. Keyes, County Clerk, for labor and materials necessary for the construction of a combination timber and steel bridge with concrete abutments, across the San Dimas Wash, on Grand Ave., about two miles northeast of Covina.

Oakland, Cal.—Until 10 a. m., Nov. 25, by John P. Cook, Clerk County Supervisors, for construction of 1,850 ft. of macadam road.

Muncie, Ind.—Until 10 a. m., Dec. 4, by Commissioners of Delaware County, for the construction of three bridges, two across the Mississinewa River and one across White River.

Newport, Ind.—Until 10 a. m., Dec. 4, by County Commissioners, for construction of superstructure for bridge over Wabash River.

Paoli, Ind.—Until 2 p. m., Dec. 3, by County Commissioners, for constructing new floor for Finley Bridge over Lost River in Orleans Township.

Emporia, Kan.—Until noon, Nov. 30, by Jno. E. Martin, County Clerk, for constructing stone abutments for two bridges.

Jackson, Minn.—Until Dec. 10, by P. D. McKellar, County Auditor, for constructing 100 ft. steel bridge and approaches in Jackson.

Castle Haynes, N. C.—Until 3 p. m., Jan. 7, by D. McEachern, Chairman County Committee, Wilmington, N. C., for a steel highway bridge approximating 400 ft., including draw span, over North East River at Castle Haynes. Bids are to include foundations; depth of water about 32 ft. Bridge to have 16-ft. road clearance and to carry 15-ton road roller. Design of bridge and details to be submitted by the bidders.

Jersey City, N. J.—Until 2 p. m., Nov. 25, by Geo. T. Bouton, Clerk Board Street and Water Commissioners, for repairing water pipe bridge and sidewalk bridge over P. R. R. cut at Summit Ave.

Newark, O.—Until Nov. 25, by County Commissioners, for constructing superstructure for 105 ft. span, pin connected truss bridge.

Pottsville, Pa.—Until 10 a. m., Nov. 29, by Charles T. Straughton, County Controller, for constructing bridge at Auburn. Bids are also asked for repairing three bridges.

Knoxville, Tenn.—Until Nov. 21, by Board Public Works, for constructing Vine Ave. viaduct over First Creek.

Spokane, Wash.—Until 2 p. m., Nov. 29, by County Commissioners, for constructing bridge over Rock Creek on the Hoxie Road.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Dec. 12, by Capt. Chas. C. Walcutt, Jr., Constructing Q. M., Prescott, Ariz., for construction, plumbing, hot water heating and electric wiring hospital at Whipple Barracks.

Pine Bluff, Ark.—Until Nov. 23, by Fred Wilson, Superintendent of Construction, for heating and ventilating high school.

Los Angeles, Cal.—Until 2 p. m., Dec. 9, by C. G. Keyes, County Clerk, for labor and material necessary for remodeling steam heating plant of physician's residence, administration building, wards 5 and 6, surgical ward, insane ward and consumptive ward, at the County Hospital of Los Angeles County.

Washington, D. C.—Until noon, Nov. 23, by District Commissioners, Room 43, District Bldg., for construction of 4-room addition to Emery school building at Lincoln Ave. and Prospect St., N. E.

Chicago, Ill.—Until 11 a. m., Nov. 30, by Department Public Works, 322 City Hall, for constructing 2-story and basement brick and stone bath house at 1224 North Marshfield Ave.

Chicago, Ill.—Until 2 p. m., Dec. 9, by Commanding Officer, I. N. G., 16th St. and Michigan Ave., for construction of proposed armory for 7th Regiment Illinois National Guard. Drawings, etc., at office W. Carbys Zimmerman, State Architect, 1101 Steinway Hall, Chicago.

Chicago, Ill.—Until 11 a. m., Nov. 25, by William Carroll, City Electrician, for furnishing and installing interior conduit and wiring at Lawrence Ave. intercepting sewer station, and for installing 246 16 c.p. incandescent lamps, ten 5-ampere arc lamps, two 10-h.p. 110 volt A. C. motors, one 15-ton crane and two 65 k.w. d. c. machines.

South Bend, Ind.—Until 3 p. m., Jan. 2, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction of an extension to and the remodeling, etc., of the U. S. Post Office at South Bend.

New Roads, La.—Until Nov. 26, by N. P. Phillips, President Police Jury, Torras, La., for remodeling and enlarging Pointe Coupee parish jail at New Roads. E. G. Beuker, Sheriff. E. J. Hull, Architect, Alexandria, La.

Jersey City, N. J.—Until 4 p. m., Nov. 26, by Walter O'Mara, Clerk County Freeholders, for erection and completion of a new tuberculosis hospital at Secaucus, N. J. Frederick Hensel, Architect, 246 Summit Ave., West Hoboken, N. J.

Jersey City, N. J.—Until 9 p. m., Nov. 21, by Fred Ege, Secretary, Board of Education, City Hall, for erection of school building in plot adjacent to school No. 14, on Union St. John T. Rowland, Jr., Architect, 15 Exchange Pl.

Albuquerque, N. Mex.—Until 3 p. m., Jan. 3, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Albuquerque.

New York, N. Y.—Until 10 a. m., Nov. 27, by Theodore A. Bingham, Police Commissioner, 300 Mulberry St., for making repairs to heating systems of 22 precinct police station houses in Manhattan Borough, and 31 station houses in the other boroughs of New York City.

Madison Barracks, N. Y.—See under Bids Asked—Water Supply.

Allentown, Pa.—Until 4 p. m., Dec. 3, by County Commissioners, for constructing addition to county jail.

Pottsville, Pa.—Until 10 a. m., Nov. 29, by Charles T. Straughton, County Controller, for repairing county hospital.

Pulaski, Tenn.—Until noon, Dec. 9, by G. H. McMillion, County Judge, for erection of new 2-story and basement, brick and stone, fireproof court house at Pulaski. B. B. Smith, Architect, 22½ Perry St., Montgomery, Ala.

Fort Worden, Wash.—Until 11 a. m., Dec. 2, by Lieut. Chas. C. Burt, Constructing Q. M., for constructing a 2-company barrack building at Fort Worden, and furnishing and installing fixtures and watt meters in the building for electric lighting.

Milwaukee, Wis.—Until 5 p. m., Nov. 25, by Frank M. Harbach, Secy. School Directors, for constructing 9-room addition to school building at 9th and Ring Sts.

Milwaukee, Wis.—Until 10:30 a. m., Nov. 26, by Charles J. Poetsch, Chairman Board Public Works, to renovate, paint and decorate the municipal court room and judges' chambers in the city hall.

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Chicago, Ill.—Until 11 a. m., Nov. 23, by Department Public Works, 224 City Hall, for constructing vitrified brick pavement on private driveway from Sebor St.

Ottawa, Ill.—Until Nov. 27, by Charles F. Wilson, Secretary Board of Local Improvements, for constructing 41,000 sq. yds. of brick pavement with granitoid curbs, gutters and cross walks.

Columbus, Ind.—Until 10 a. m., Dec. 2, by Commissioners of Bartholomew County, for the construction of a gravel road in Clifty Township, 1½ miles long.

Danville, Ind.—Until 10 a. m., Dec. 5, by David D. Mills, County Auditor, for constructing 1¼ miles of gravel road in Marion Township.

Monticello, Ind.—Until noon, Dec. 3, by J. L. Ackermnn, County Auditor, for the construction of a stone road on the township line between Union and Honey Creek Townships; two stone roads in Jackson Township; a stone road in Union Township and a stone road in Princeton Township.

Greencastle, Ind.—Until 11 a. m., Nov. 30, by Commissioners of Putnam County, for the construction of a macadamized road in Jackson Township, 16,371 ft. long.

Logansport, Ind.—Until 10 a. m., Dec. 4, by George W. Cann, County Auditor, for constructing three gravel roads in Clinton Township and one gravel road in Washington Township.

Salem, Ind.—Until 1:30 p. m., Dec. 2, by Sam. G. Ellis, County Auditor, for the construction of a gravel road in Washington Township 11,680 ft. long., estimated to cost $10,211.

Sullivan, Ind.—Until noon, Dec. 2, by E. E. Russell, County Auditor, for construction of 15,400 ft. of gravel road in Haddon Township.

Vincennes, Ind.—Until 2 p. m., Nov. 26, by Board of Works, for grading and graveling Bayou St.

Kansas City, Mo.—Until 11 a. m., Nov. 27, by E. A. Harper, City Engineer, for construction of asphalt pavement on portions of 24 streets.

Kansas City, Mo.—Until 11 a. m., Nov. 30, by E. A. Harper, City Engineer, for constructing asphalt pavement on portions of 24 streets.

Flemington, N. J.—Until 10 a. m., Dec. 12, by John H. DeMott, Director Board of Freeholders, for constructing 34,200 ft. of Macadam road. Grant Davis, County Engineer, White House, N. J.

Woodbury, N. J.—Until 8 p. m., Nov. 25, by John E. Estell, City Clerk, for constructing 2,950 sq. yds. of Warren's Bitulithic pavement in South Broad St. William M. Carter, Engineer, Woodbury.

Cincinnati, O.—Until noon, Nov. 25, by M. J. Keefe, Clerk Bd. Pub. Service, for improvement of McPherson Ave. by grading, setting sandstone straight curbs and granite circular curbs, paving the gutters with granite blocks, macadamizing the roadway and constructing the necessary drains, basins and retaining walls.

Erie, Pa.—Until Nov. 25, by City Clerk, for paving 12th St.

Pittsburg, Pa.—Until 10 a. m., Nov. 22, by A. B. Shepherd, Director of Public Works, for repaving with asphalt Shady Ave. from Penn Ave., south to P. R. R. bridge.

Scranton, Pa.—Until 11 a. m., Nov. 25, by C. R. Acker, Director Public Works, for constructing flagstone walks.

Pittsburg, Pa.—Until 2 p. m., Nov. 22, by F. P. Booth, County Controller, for constructing cement sidewalk along 4th Ave. and Ross St.

Galveston, Tex.—Until noon, Nov. 21, by John D. Kelley, City Secretary, for constructing 4,395 sq. yds. of vitrified brick pavement on Ave. B. and 5,806 sq. yds. on Ave. D. A. T. Dickey, City Engineer.

Milwaukee, Wis.—Until 10:30 a. m., Nov. 25, by Charles J. Poetsch, Chairman Board Public Works, for paving with bitulithic on 12th St.: certified check for $4,200 required with bid. Bids are also asked for paving with bitulithic on Teutonia Ave.; certified check for $3,600 being required with bid.

Milwaukee, Wis.—Until 10:30 a. m., Nov. 25, by Charles J. Poetsch, Chairman Board Public Works, to grade the roadway to a subgrade and to pave the same with a permanent bitulithic pavement having a concrete foundation, and to curb the sidewalks with stone (old curbing to be reset) on 4th St. Certified check for $2,850 required with bid.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Until noon, Nov. 25, by District Commissioners, for constructing sewers. Specifications, etc., at Room 43, District Bldg.

Des Moines, Ia.—Until 11 a. m., Dec. 4, by Board of Public Works, for constructing 968 lin. ft. of 12-in. vitrified clay pipe sewer.

Des Moines, Ia.—Until 11 a. m., Nov. 23, by Board Public Works, for constructing 312 ft. of 24-in. clay pipe sewer in Pleasant St.

Dubuque, Ia.—Until 8:30 p. m., Nov. 21, by Edmund A. Linehan, City Recorder, for constructing 750 ft. of 8-in. tile pipe sewer and three manholes in Kaufman Ave.

Cairo, Ill.—Until 10 a. m., Nov. 25, by Ernest Nordman, Secretary Board Public Works, for constructing vitrified tile pipe sewers, house connections and inlets and brick manholes in all cross streets between

21st St. and 28th St. and W. 28th St. and part of Walnut St. Bids are also asked for filling with earth unfilled portions of said streets.

Lafayette, Ind.—Until 7:30 p. m., Nov. 27, by E. H. Andress, Jr., Clerk Bd. Pub. Wks., for constructing local sewer in Central St. and branch sewers in 9th St., 10th and 11th Sts.

Indianapolis, Ind.—Until 10 a. m., Nov. 22, by Board Public Works, for constructing local sewer in first alley west of Arsenal Ave.

St. Paul, Minn.—Until 2 p. m., Nov. 25, by R. L. Gorman, Clk. Bd. Pub. Wks., for constructing sewer on Bradley St.; also for constructing sewer on Arcade and Hawthorne Sts.

Jersey City, N. J.—Until 2 p. m., Nov. 25, by Geo. T. Bouton, Clk. Street and Water Commissioners, for constructing sewer in Beacon Ave., the work including 325 lin. ft. 15-in. pipe sewer, 100 cu. yds. rock excavation, etc.

Marcy, N. Y.—Until 7 p. m., Dec. 7, by Sewer Commissioners, for constructing 1,500 ft. of vitrified pipe sewer.

Allegheny, Pa.—Until 10 a. m., Nov. 23, by Simon Kerschler, Director of Charities, for construction of a sewage disposal plant at City Home. Estimated cost is $10,000.

Erie, Pa.—Until Nov. 25, by City Clerk, for constructing sewer in 14th St.

Kingston, Pa.—Until noon, Nov. 21, by W. J. Williams, Borough Secretary, for construction of Slocum Ave. sewer. Young & Wintermute, Engineers, Wilkesbarre, Pa.

Pittsburg, Pa.—Until 10 a. m., Nov. 22, by A. B. Shepherd, Director Public Works, for constructing a 42-in. brick sewer in private property, a 10-in. pipe sewer in Enola Alley, a 15-in. pipe sewer in Elmer St., a 15, 18 and 20-in. pipe sewer in Murray St., and 15-in. sewers in Juniper St., Bedford Ave., Naucen St. and Denniston Ave.; also 20-in. pipe relief in Aiken Ave.

Norfolk, Va.—Until noon, Nov. 28, by J. D. Hank, Jr., Secretary Local Board 7th Ward, for constructing part of sewer system in said ward, the work including 1,000 lin. ft. 10-in. terra cotta pipe lateral sewer, 24,000 lin. ft. 8-in. terra cotta pipe lateral sewer, 24,000 lin. ft. 4-in. terra cotta pipe house connections, 50 manholes, 35 flush-tanks. W. T. Brooke, City Engineer.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Madison Barracks (P. O. Sacketts Harbor), N. Y.—Until 11 a. m., Nov. 27, by Constructing Q. M., for constructing a 300,000 gallon steel tank, Q. M. stable, one set quarters, wagon shed and remodeling old mess room buildng.

Fort Stevens, Ore.—Until 2 p. m., Nov. 21, by Constructing Q. M., for the construction of a cistern for the storage of rain water for use in one double and one single set of officers' quarters at Fort Stevens.

Cambridge Springs, Pa.—Until 7:30 p. m., Dec. 12, by A. H. Drake, Borough Clerk, for construction of mechanical filter plant.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

Emmetsburg, Ia.—Ditch Work.—Until Dec. 11, by S. R. Steadman, County Auditor, for constructing drainage improvements Nos. 6, 12, 15, 16, 18, 19, 23, 25 and 26.

Anderson, Ind.—Ditch.—Until 10 a. m., Nov. 27, by Edwin J. Wilcox, Superintendent of Construction, for labor and material for constructing Charles E. Baxter ditch. Ditch is to be constructed of 8-in. to 24-in. drain tile, except for about 800 ft. of open ditch.

Decatur, Ind.—Ditch.—Until 10:30 a. m., Nov. 23, by Ditch Superintendent of Adams County, for the construction of a farm ditch

Wheaton, Minn.—Ditch.—Until Dec. 3, by N. F. Schroeder, County Auditor, for construction Section 1, of Ditch No. 2.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Chicago, Ill.—Iron Plate Floor.—Until 11 a. m., Nov. 26, by Department Public Works, 221 City Hall, for labor and materials for setting and constructing all cast iron plate floor work required in Lawrence Ave. Pumping station.

Danville, Ill.—Telephone System.—Until 10 a. m., Dec. 4, by M. J. Barger, Treasurer, Danville Branch, N. H. D. V. S., for labor and materials for installing telephone system.

Chinook, Mont.—Electric Light Works.—Until 2 p. m., Dec. 21, by Jno. C. Duff, Town Clerk, for constructing system of electric light works.

Brooklyn, N. Y.—Snow and Ice Removal.—Until noon, Nov. 29, by W. Bensel, Commissioner of Street Cleaning, 13 Park Row, New York, for contract for furnishing all labor and materials for removal of snow and ice from the eight districts of the Borough of Brooklyn. Security required is $10,000 for each district.

New York, N. Y.—Building Scows.—Until noon, Nov. 27, by W. Bensel, Commissioner of Street Cleaning, 13 Park Row, for labor and materials for building 15 scows.

New York, N. Y.—Snow and Ice Removal.—Until noon, Nov. 29, by W. Bensel, Commissioner of Street Cleaning, 13 Park Row, for labor and materials for removing snow and ice from 11 districts in Manhattan Borough and 2 districts in the Bronx. Security required for each district is $10,000. Contractor will be paid per cubic yard for actual amount of snow and ice removed and dumped.

Durhamville, N. Y.—Aqueduct.—Until noon, Nov. 26, by F. C. Stevens, Superintendent of Public Works, Albany, N. Y., for constructing a new aqueduct under the Erie Canal at Durhamville on the line between the counties of Madison and Oneida, and work incidental thereto. Plans, etc., at the office of the Superintendent of Public Works, Albany, N. Y.; at the office of Charles C. Barrett, Assistant Superintendent of Public Works, Syracuse, N. Y., and at the office of Oscar H. Peacock, Assistant Superintendent of Public Works, Rochester, N. Y.

Governor's Island, N. Y. H.—Vessel Repairs.—Until 11 a. m., Nov. 22, by Jno. W. Pullman, Chief Q. M., Governor's Isand, N. Y. H., for repairs to steam launch "Lieut. L. H. Lewis."

Columbus, O.—Tunnel, Boiler Foundations.—Until Nov. 25, by E. F. McGuire, Secretary Board Public Service, for construction of boiler foundations and tunnel at municipal light pant.

Portland, Ore.—Steamboat.—Until 11 a. m., Dec. 20, by Lt. Col. S. W. Roessler, U. S. Engrs., for construction of one stern wheel steamboat. Official advertisement will be found elsewhere in this issue.

Ottawa, Ont.—Wharf.—Until Nov. 26, by Fred Gelinas, Secretary Department Public Works, Ottawa, for constructing crib wharf and stone approach at Thunder Bay, Ont.

Pittsburg, Pa.—Boardwalk and Steps.—Until 10 a. m., Nov. 22, by A. B. Shepherd, Director of Public Works, for constructing boardwalks and steps in portions of 36th St., Atlantic Ave., Morningside Ave. and Hall St.

Reading, Pa.—Garbage Disposal.—Until Dec. 3, by City Comptroller, for disposing of City Garbage for a term of years. Elmer H. Beard, City Engineer.

Buenos Aires, Argentina.—Subways.—Bids accompanied by plans are being asked by the Municipality of Buenos Aires, until May, 1908, for the construction, on its own account, of two of the principal lines constituting the proposed system of Metropolitan Subway Electric Railway. At the same time, and for the purpose of facilitating the financial combinations of the interested companies, it calls for bids for the lease of the exploitation of the two lines as soon as construction is completed. Preliminary plans are on file at the Argentine Legation, Washington, D. C.

Materials, Machines, Supplies, Tools, Etc.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Pumps, Blocks, Rope, Etc.—Until 10:30 a. m., Dec. 6, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Canal Circular 402—Pumps, engine lathe, pneumatic tools, hose, steel plates and angles, iron roofing, wire cloth, zinc, repair parts for steam shovels, orange-peel buckets, spuds and handles for dipper dredges, bolts, nuts, chain, boiler tubes, copper tubing, Tobin bronze, iron pipe and fittings, valves, packing, rubber disks, tackle blocks, Manila rope, screw jacks, blacksmith drills, vises, anvils, forges, charcoal furnaces, molder's bellows, car replacers, locks, door bolts, flue cleaners, wire rope clips, etc.

Washington, D. C.—Lumber, Angles, Etc.—Until 10:30 a. m., Dec. 13, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Canal Circular 403, the following: Lumber, stern spud for dipper dredge, repair parts for steam shovels, driving wheel tires, and centers for locomotives, motor generator sets, switchboard, electric fans, electric switches and fuse blocks, steel plates and angles, closet seats and attachments, bail cocks, chain, sink bolts, lag screws, pipe-threading machines, bolt taps, pipe bend gauge cocks, bibbs, steam whistles, copper pipe, salinometers, band saws, calorimeter, rules, planimeters, protractors, ranging poles, etc.

Atlanta, Ga.—Boiler.—Until 11 a. m., Nov. 26, by Col. J. W. Pope, Chief Q. M., for supply f. o. b. cars at Port Royal, S. C., of one 30 H. P. boiler.

Tipton, Ind.—Water Heater.—Until 10 a. m., Nov. 22, by Commissioners of Tipton County, for the construction of a water heater at the county jail.

Jersey City, N. J.—Gate Boxes, Covers, Etc.—Until 2 p. m., Nov. 25, by Geo. T. Bouton, Clerk Street and Water Commissioners, for furnishing and delivering water gate boxes and covers and manhole heads and covers.

Jersey City, N. J.—Special Castings.—Until 2 p. m., Nov. 25, by Geo. T. Bouton, Clerk Board Street and Water Commissioners, City Hall, for furnishing and delivering special castings, such as hydrant connections, plugs, caps, sleeves, half sleeves and over sleeves, etc.

Sonyea, N. Y.—Boilers.—Until 2 p. m., Nov. 20, by Percy L. Lang, President Board of Managers, for furnishing and setting two return flue, internal fired boilers in the Women's Infirmary, at the Craig Colony for Epileptics, Sonyea.

Tompkinsville, N. Y.—Lanterns.—Until 1 p. m., Dec. 16, by the U. S. Light House Engineer, Tompkinsville, for furnishing two fourth order lanterns for Honolulu Range Light Stations, Hawaii. Official advertisement will be found elsewhere in this issue.

Cincinnati, O.—Water Meters.—Until Nov. 25, by M. J. Keefe, Clerk Board Public Service, for furnishing water meters for period ending Dec. 21, 1907.

Minerva, O.—Boiler.—Until Dec. 4, by L. E. Weber, Secretary Board Public Affairs, for a 150 h.p. boiler.

Avalon (P. O., Allegheny), Pa.—Fire Hose.—Until 7 p. m., Nov. 21, by Borough Clerk, for furnishing 800 ft. of fire hose.

Hollidaysburg, Pa.—Water Pipe.—Until noon, Dec. 3, by W. M. Brown, Secretary Directors of Poor, for furnishing 3¼ miles of 4-in. cast iron pipe or spiral riveted dip coated iron pipe.

Philadelphia, Pa.—Machinery.—Until noon, Nov. 21, by Geo. R. Stearns, Director of Public Works, for machinery at filter plant.

Pittsburg, Pa.—Gas Engines, Pipe, Etc.—Until 10 a. m., Nov. 25, by A. B. Shepherd, Director Public Works, for furnishing Bureau of Filtration the following: (1) Gas engine; (2) laboratory supplies; (3) electrical testing apparatus; (4) rifled pipe.

Providence, R. I.—Elevator Equipment.—Until 3 p. m., Nov. 26, by James Knox Taylor, Supervising Architect, Washington, D. C., for the elevator equipment for the U. S. Post Office, Court House and Custom House, Providence, R. I. Clarke & Howe, Architects, 72 Weybosset St., Providence, R. I.

Nashville, Tenn.—Lumber.—Until 11 a. m., Dec. 14, by Maj. Wm. W. Harts, U. S. Engrs., for furnishing and delivering about 1,258,695 ft. BM. long leaf yellow pine lumber.

Madison, Wis.—Boilers, Engines, Etc.—Until noon, Nov. 22, by Lew F. Porter, Secretary Capitol Commission, Madison, for separate proposals for furnishing each of the following kinds of equipment for the heating and power plant for the Capitol now building at Madison: Boilers, engines, electrical generators and motors, mechanical stokers, pumps (feed), pumps (building supply), storage tanks, conveying machinery, hoisting crane, open heaters. All to be according to the plans and specifications of Storm Bull, Consulting Engineer, Madison, Wis.

CONTRACTS LET.

The following contracts have been let recently:

St. Augustine, Fla.—Paving.—B. E. Pacetti for paving San Marco Ave.

Muscatine, Ia.—Post Office.—W. J. McAlpine, Dixon, for new U. S. Post Office at this city.

Ida Grove, Ia.—Bridge. Lingren & Co., Des Moines, Ia., at $3,450, for bridge 80 ft. span, 75 ft approach, over Maple River.

Cullom, Ill.—Water Mains.—Kingdon & Kingdon, at $9,500, for laying water mains.

Duquoin, Ill.—Sewer System.—Reeb Bros., Belleville, Ill., at $30,000, for new sewer system for this place.

Highland, Ill.—Water Main.—August Geissler, at $1,500, for water main extension in Newton St.

Oregon, Ill.—Bridge.—M. M. Billmire Co., Rochelle, Ill., at $2,100, for single span girder bridge with cement roadway on Oregon and Grand Detour Road.

Springfield, Ill.—Paving. Sewer. — Henry Welch for paving portions of Park Ave. and Laurence Ave.; John Spence, for 18 in. sewer in Miller St.

Springfield, Ill.—Resurfacing.—M. L. Windham, Springfield, at $3,100 for resurfacing racetrack at state fair grounds.

Greencastle, Ind.— Roadwork.— Keegan Bros., Brazil, Ind., at $6,149, for Claud H. Pruitt Road; Shannon & Sutherlan, at $6,112, for Road No. 6, Russell Township.

Indianapolis, Ind.—Sewers.—John Jenkins for local sewer in Bonna Ave.; Aetna Construction Co., for local sewer in Roanoke St.

Bluffton, Ind. — Tile Drain. — Andrew Springer at $1,287, for contracting 5,644 ft. of tile drain and a 1,000 ft. lateral.

Decatur, Ind.—Roadwork.—Wm. Reppert, at $3,090, for constructing Decatur and Bluffton macadam road extension. L. O. Bears at $3,559, for construction of Elzey macadam road.

Indianapolis, Ind.—Paving, Sewers.—American Construction Co., for graveling roadway, cement curbs and walk on Wilson St.; Sheehan Construction Co., for local sewer in Washington Boulevard.

Jeffersonville, Ind.—Sewer.—W. O. Sweeney at about $2,500, for sewer in E. 7th St.

Lafayette, Ind.—Sewer.—Wm. F. Frey, at 93 cts. per lin. ft., for sewer in 11th St.

Richmond, Ind.—Bridge Work.—Pan-American Bridge Co., New Castle, Ind., at $14,625, for constructing eight bridges and two arches and for repairing two bridges for the county.

Vincennes, Ind.—Bridge.—Vincennes Bridge Co., at $12,075, for 20 bridges for Knox County.

Wichita, Kans.—Bridges.—Wichita Construction Co., at $5,600, for superstructures and $800 for substructures for five steel bridges with stone abutments for the county.

Baltimore, Md.—Paving.—F. E. Schneider & Co., Law Bldg., at $2,793, for paving portion of 28 A St. with vitrified brick.

Thief River Falls, Minn.—Bridge.—Hennepin Bridge Co., at $15,950, for new bridge over Red Lake River.

St. Paul, Minn.—Sewer.—Nicholas Feyen, at $1,519, for sewer in St. Anthony Ave.

Kansas City, Mo.—Railroad Ballasting.—L. J. Smith, Kansas City, Mo., has been awarded contract for ballasting with gravel all tracks of Iron Mountain R. R. in Arkansas and Louisiana. Contract is reported to total $1,500,000.

Mexico, Mo.—Railway Crading.—J. M. Wolf, Collinsville, Ill., for grading between Mexico and Perry for road bed of electric railway projected by the Mexico & Perry Traction Co., of which S. L. Robinson, Mexico, is President. The road will be 25 miles long.

Fargo, N. Dak.—Bridges. — Northwestern Bridge Co., at $22 per lin. ft., for six steel bridges, each 60 ft. long, to be erected over the Stanley Drain No. 27, for Cass County.

East Orange, N. J.—School Building.—Edward M. Waldron, Newark, for erection of school building in this city.

Newark, N. J.—Church.—Winterbottom & Van Houten, 148 N. J. R. R. Ave., for erection of edifice for Grace Methodist Episcopal Church.

Long Island City, N. Y.—Paving.—Barber Asphalt Paving Co., 114 Liberty St., New York, at $10,661, for paving with asphalt block on Onderdonk Ave., Ridgewood Heights, Hastings Pavement Co., 25 Broad St., New York, at $9,454, for paving with asphalt on Academy St.

Cincinnati, O.—Bridge Approaches.—A. J. Henkel, at $6,389, for building approaches to Bright bridge.

Zanesville, O.—Grading.—F. B. Bannister Co., Pittsburg, Pa., for grading and laying out lots at Duncan's Falls, where six large factories, an amusement park and a new town site will be placed by the Central Valley Railway, Light & Power Co.

Lancaster, Pa.—Sewer.—Reilly & Riddle, Philadelphia, Pa., at $52,842, for completing contract for constructing 108 in. sewer for this city.

Franklin, Pa.—Hospital.—Allen & Meals, at $260,000, for constructing buildings for Polk Hospital Trustees.

Carbondale, Pa.—Sewer.—R. A. Blackwood, at 80 cts. per lin. ft. of sewer in Parish Court.

Lancaster, Pa.—Sewer.—Reilly & Riddle, Lancaster, at $49,650, for constructing sewer in Water St.

New Castle, Pa.—Sewers.—Lewis Meyer, contract for constructing a sewer; Marquis & Wallace, contract for two sewers.

Philadelphia, Pa.—School Building.—Lynch Bros., Lippincott Bldg., at $124,116 for constructing Montgomery Ave. school building.

Washington, Pa.—Road Work.—Hallam Construction Co., at about $10,000, for constructing Taylorstown Road.

Williamsport, Pa.—Filling and Grading.—E. Whalen & Co., at $11,287, for filling and grading for extension of W. 3rd St.

Fort Meade, S. Dak.—Roads and Walks.—Graves & Schummer, Sturgis, S. Dak., at $7,900, for constructing roads and walks at this post.

Jackson, Tenn.—Concrete Walks.—Jackson Marble & Concrete Co., at $1,400, for concrete walks around the courthouse.

Lynchburg, Va.—Dam.—C. W. Hancock & Sons, Lynchburg, for the erection of a concrete dam in Cedar Creek, for power development purposes.

PROJECTED WORK.

Bridges.

Items Arranged Alphabetically by States.

Gadsden, Ala.—Louisville & Nashville R. R., according to reports, is to erect a new bridge over Coosa River at this place. W. H. Courtenay, Louisville, Ky., is Chief Engineer.

Iowa City, Ia.—Council has appropriated $1,500 for erection of abutment to new bridge over Iowa River.

Chicago, Ill.—Sanitary District proposes to erect a double bascule bridge over the river at Lake St. Bridge would cost $1,000,000, and plans for it are now being considered by Thos. G. Pihlfeldt, City Bridge Engineer.

Evansville, Ind.—Louisville & Nashville R. R. proposes to build double track bridge over Pigeon Creek on Water St. A. B. McVay, Evansville, is Supervisor Bridges and Buildings, L. & N. R. R.

Lafayette, Ind.—Plans have been prepared by Everett B. Vawter, for a county bridge to be erected over the Wabash River, at Granville. Bridge is to be a steel structure 645 ft. long, and county commissioners hope to award the contract next month.

Springfield, Mo.—Proposed viaduct to be erected in this city will be built at Boonville St., agreement to that effect having been reached by F. S. Hefferman, Chairman City Viaduct Committee, and E. F. Mitchell, St. Louis, Mo., Engineer of Construction for the Missouri Pacific Ry.

Cleveland, O.—Erie R R. has completed its temporary bridge over Cuyahoga River and is drawing plans for a permanent structure to cost $100,000, which will replace the bridge that collapsed recently. J. Burke, Cleveland, O., is Engineer M. of W., Erie R. R.

Troy, O.—The following bids were received by the County Commissioners Nov. 12, for bridge work: (1) Milton bridge superstructure, (2) Milton bridge substructure, (3) grading approaches to Milton bridge, (4) Ervington bridge, (5) Troy lift bridge, (6) reinforced concrete culvert: Toledo-Massilon Bridge Co. (1) $14,600, (2) reinforced plan submitted $10,600, (3) $6,380, (5) $8,125; Central States Bridge Co. (1) $14,620, (4) $6,100; Orgonia Bridge Co. (1) $14,570, (4) $6,390; Brookville Bridge Co. (1) $14,375, (4) $6,450, (5) $8,400; Taver & Renick (2) $13,675; Geo. J. Bock & Son (1), $14,610, (2) $13,700, (6) $1,600; Columbus Bridge Co. (1) $14,800, (4) $6,325; Hennessey Bros. (2) (3) (6) as a whole, $37,030.

Scranton, Pa.—County Grand Jury has recommended construction of 15 new bridges, to be steel girders on concrete foundations, and to cost from $200 to $950 each.

Beaver, Pa.—Preliminary work on the construction of the proposed new bridge of Pittsburg & Lake Erie R. R. at Beaver, will be started at once, as the U. S. War Department has approved changes in plans. J. A. Atwood, Pittsburg, Pa., is Chief Engineer, P. & L. E. R. R.

Yankton, S. Dak.—Council Committee on Bridges is considering construction of concrete bridge at Douglas Ave., to cost several thousand dollars.

Memphis, Tenn.—City Engineer Weatherford is stated to be considering plans with engineers of Illinois Central R R., for construction by the latter of a steel bridge over Bayou Gayoso on Front St.

Ogden, Utah.—Several railroad companies propose to construct a 30 ft. wide, 2,271 ft. long viaduct over their tracks on 24th St. Viaduct would cost $150,000, and among the companies interested is the Oregon Short Line R. R., of which Wm. Ashton, Salt Lake City, is Chief Engineer.

Menominee, Wis.—Council Street and Bridge Committee, acting with City Engineer, has been authorized to procure plans and specifications for a new bridge to be erected above the dam. Expenditure of $30,000 has been authorized for constructing the bridge.

Railroads

Items Arranged Alphabetically by States.

Stockton, Cal.—According to advices from this place the Southern Pacific Ry. is making preparations to double track its lines between Sacramento and Tracy.

Somerset, Ky.—Stockholders of recently organized Monticello Construction Co. have elected J. H. Shearer, President, and W. L. Baker, Secretary. The company is capitalized at $100,000, and will begin at once the building of that portion of the Cumberland River & Nashville R. R., which extends from Tateville, on the Q. and C. Road, 15 miles southwest of Monticello. The right of way has been secured. Ex-General Manager Woodward, of the Q. and C., a resident of Wyoming, O., is at the head of the new railroad.

Brainerd, Minn.—It is reported here that the Northland Pine Co. will extend its logging railroad at Cross Lake to a connection with the Northern Pacific or Minnesota & International R. R.

Clayton, Mo.—Plans and profiles, showing the proposed construction of the St. Louis, Montesano & Southern Ry. Co., through the southern part of St. Louis County, have been filed with the County Court.

Portsmouth, N. H.—Boston & Maine R. R. is to erect new bridge over Piscataqua River at a point about one-half mile above present wooden structure. The cost of the bridge will be about $400,000, an additional $800,000 will be expended for other improvements. F. A. Merrill, Concord, N. H., is Assistant Chief Engineer B. & M. R. R.

Lyons, N. Y.—New York Central & Hudson River R. R., is said to be planning to extend its Pennsylvania Division, which begins at this place, to Pittsburg, Pa., in order to secure certain eastbound freight tonnage. In order to reach Pittsburg it would be necessary to extend the Pennsylvania Division westbound from Mahsey a distance of 65 to 75 miles. Surveys are reported to have been made for the extension.

Athens, O.—A company is being formed for the purpose of constructing a belt line to circle the Hocking and Scioto Valleys. As projected, the road is to be constructed from Athens, through Nelsonville, Murray City and Gloucester, giving about 50 miles of road. Chas. S. Druggan, an Attorney of Columbus, O., is interested.

Springfield, O.—Detroit, Toledo & Ironton Ry. is reported to be planning to start work next spring on the construction of a belt line for freight purposes around this city. J. Wanbecq, Toledo, O., is Engineer.

Portland, Ore.—Bids for the construction of the tunnels for the Oregon & Washington R. R., by which the road will enter the cities of Portland, Tacoma and Seattle, have been received and contracts will be let shortly, it is said. Work will be started first on the Tacoma tunnel, which is to be 8,700 ft. long. The Seattle tunnel is to be 5,000 ft. long and the Portland tunnel will be 4,800 ft. long. The three tunnels will cost about $4,500,000. The Oregon & Washington R. R. is the Puget Sound extension of the Harriman lines. George W. Boesche, Portland, Ore., Chief Engineer of Oregon R. R. & Navigation Co., will be in charge of the work.

McKeesport, Pa.—Final estimates of the cost of extending the four-track system of the Pittsburg & Lake Erie R. R. between Pittsburg and McKeesport, will be submitted shortly to an executive official of the above road. The estimated cost of the new work is $3,000, and additional tracks are necessary on account of the increased traffic. J. A. Atwood, Pittsburg, Pa., is Chief Engineer.

Newport, Pa.—Newport & Sherman's Valley R. R., David Gring, President, Newport, Pa., proposes to change its track from a 3 ft. gage to standard. Company operates 30 miles of line.

Yankton, S. Dak.—Surveys for the projected Yankton, Wichita & Houston R. R., are now being made between Maple City, Kans., and Bennington, I. T., passing via Wellington, Kans., and the Otoe Indian reservation in Oklahoma and through the Cleveland oil field. Fremont Hill, Cincinnati, O., is President of the road, and with other Cincinnati capitalists is furnishing the money for the construction.

Stanton, Tex.—Work has been started at this place on the construction of the West Texas & Northern Ry. The O'Donnell Contracting Co. has the contract for several sections of the road. The road, as projected, is run from Amarillo south to the gulf, and location surveys and construction figures for the 500 miles of line are stated to have been secured. S. G. Bon Durant is interested.

Spokane, Wash.—Spokane & British Columbia Ry., according to advices from this city, has secured three-fourths of the right of way for its line from Grand Forks, B. C., to this city. Necessary capital is said to have been secured for the road, which is under construction from Grand Forks, W. H. Warringer, Grand Forks, B. C., is interested.

Electric Railways.

Items Arranged Alphabetically by States.

Hot Springs, Ark.—Citizens of this place and Little Rock have taken enough capital stock in the Little Rock & Hot Springs Electric Ry. to assure the building of the road. It is hoped to have work started by Jan. 1.

Napa, Cal.—Standard Portland Cement Co., which has plant at Napa Junction, is to build electric railway from that place to Napa River, 2½ miles, for the purpose of transporting cement.

Pueblo, Colo.—N. C. Vannatta, Chief Engineer of the Pueblo & Arkansas Valley Electric Ry., has been instructed to continue surveys to Rocky Ford for the projected electric road of the above company. It is stated that construction work on that portion of the line between Pueblo and Blende will be started as soon as a few difficulties are cleared up about the right of way. N. Douthitt, Kansas City, Mo., is the promoter.

Marietta, Ga.—Citizens of this place, Powder Springs and Macland backed by capitalists of Atlanta, are to form the Marietta-Macland Ry. Co., for the purpose of constructing an electric railway between the points named and on to Atlanta. Mass meeting was recently held in Marietta to further the project.

Des Moines, Ia.—Residents of this city owning property at Spirit and Okobiji Lakes, are taking active interest in project to build an interurban line from the lakes to Sioux City, and it is possible that in addition to the direct line from Spirit Lake to Sioux City, a loop will be built around the lakes. Henry Miller, Spirit Lake, Ia., and J. L. Myerly, Des Moines, are reported to be interested.

Iowa City, Ia.—Charles P. Murray & Co., Cedar Rapids, Ia., has asked for franchise here for a street railway.

Dubuque, Ia.—Location surveys for the Minneapolis, Rochester & Dubuque interurban, the Dan Patch Air Line, are practically completed to this city,, and it is reported that actual construction work will be started next year.

Evansville, Ind.—Evansville Electric Ry. Co., owners of local electric railway and the Princeton, Ind., traction line, has issued $500,000 of stock, and it is understood that the proceeds will be used to cover the cost of building a new line through the northeastern part of the city, probably out Michigan or Columbia Sts.; also that it will provide funds for building the extension to Patoka and Hazleton, north of Princeton.

Evansville, Ind.—Surveys have been completed for the extension of the Evansville & Rockport traction line from Rockport to Grandview, and according to reported statement of W. L. Sonntag, Evansville, General Manager of the road, the work will be started in the spring.

LaGrande, Ind.—St. Joseph Valley Ry., operating 27 miles of road, will electrify its present steam line. M. L. Swinehart, LaGrande, is Chief Engineer.

Plymouth, Ind.—Indianapolis, Logansport & South Bend Ry. Co., which proposes to build a line from South Bend to Logansport, has been granted a franchise in Plymouth. The company, which has its headquarters in South Bend, propose to start work early in the spring, it is said.

Parsons, Kans.—C. D. Moore, representing Huntington, W. Va., parties, has been granted franchise for a seven mile street railway system in this city. According to the franchise five miles of track are to be completed in 12 months.

Mexico, Mo.—Mexico & Perry Traction Co. incorporated last April, with $850,000 capital stock, has awarded contract for grading its line between Mexico and Perry to J. M. Wolf, Collinsville, Ill. The road will be 25 miles long, and it is announced that it will be in operation within a year. A. L. Robinson, Mexico, Mo., is President.

Fremont, Neb.—Fremont Commercial Club is advocating establishment of street railway system here and recently J. C. Berry, of Minneapolis, Minn., representing a firm that builds street railways and J. H. Mithen, Omaha, Neb., were in the city looking over the field.

Oklahoma City, Okla.—With headquarters in this city and Durant, Ind. T., and capital stock of $5,000,000, the Red River Ry. Co. has been chartered. It proposes to build an electric line from a point on the Texas State line, just north of Bonham, Tex., to Oklahoma City, 200 miles. The incorporators are George F. Robertson, of Atoka; E. M. Abernathy, S. C. Hawk and F. J. Hawk, Lexington; Albert Rennie, Pauls Valley; F. P. Kibbey, of Byars; J. W. Hocker, of Purcell, and T. H. Bayless, of Durant.

Tecumseh, Okla.—Rapid Transit Interurban Co., with capital stock of $2,500,000 and headquarters at this place, has been chartered and proposes to build an electric interurban line from Muskogee southwest 137 miles via Tecumseh to Chickasha, with a cross line provided northwest from Tecumseh 55 miles to Guthrie, and south from Tecumseh 55 miles to Sulphur, a total distance of 277 miles. John A. Clark, S. B. Mitchell, J. W. Saxon, G. M. Cissna, T. J. Ray and M. H. Tennison, all of Tecumseh, are incorporators.

Portland, Ore.—Portland Railway, Light & Power Co., is having estimates of cost made of double tracking its suburban line to Mount Scott.

Lockhart, Tex.—City Council has granted six months' extension to franchise of Texas. Interurban Ry. Co. of which Col. Thomas Moore, Austin, Tex., is President.

Walla Walla, Wash.—Max Baumeister, Allen H. Reynolds. Samuel Drumheller, C. K. Holloway, John Smith, W. A. Ritz, E. S. Isaac, J. L. Sharpstein of Walla Walla, have taken out incorporation papers for the Washington-Oregon Traction Co. Capital stock is $1,500,000, and it is said that construction will be commenced within a year on at least 75 miles of electric line operating out of Walla Walla. Power will be secured from the Wenaha River about 25 miles from Walla Walla. Power will also be furnished for manufacturing enterprises.

Electric and Gas Plants.

Items Arranged Alphabetically by States.

Birmingham, Ala.—Greater Birmingham Electric Light & Power Co. has been organized with J. M. Bradley as President, and will erect power house.

Crested Butte, Colo.—Crested Butte Light & Water Co., capitalized at $50,000, has been incorporated by Henry C. Wright and others.

Telluride, Colo.—The Beaver River Power Co., of this city, has been incorporated. Lucien B. Fuller, L. L. Nunn, William L. Bierbach are interested.

Cairo, Ill.—The Cairo Electric & Traction Co. will improve its power plant.

Springfield, Ill.—Preliminary work has been started on construction of new power plant for the John H. Brinkerhoff Heat & Lighting Co.

Bicknell, Ind.—Lighting franchise in this town has been granted J. E. Winter and George Cleveland.

Jefferson, Ia.—Local electric light plant will be improved. Percy Gray is manager.

Princeton, Ill.—Bureau County Light & Power Co., capitalized at $50,000, has been incorporated. H. H. Priestly is interested.

Bowling Green, Ky.—Bowling Green Ry. & Gas Light Co. will build a new power plant on the Portage Railroad.

Baltimore, Md.—Consolidated Gas, Electric & Power Co. is preparing to make extensive improvements to its sub-station at Penn and Pratt Sts.

Garden, Mich.—Erection of municipal light plant proposed.

Ishpeming, Mich.—Marquette County Gas & Electric Co. will enlarge its plant.

Kalamazoo, Mich.—Power plant franchise has been granted Frank Armstrong.

Muskegon Heights, Mich.—City is considering erection of municipal lighting plant.

Owosso, Mich.—Owosso Light & Power Co. has been organized and proposes to build dam 500 ft. long and 30 ft. high across Shiawassee River, 2½ miles from this city, for purpose of generating electricity for proposed Grand Rapids-Pontiac electric line and for this city. E. M. Hopkins, Detroit, Mich., promoter of the electric railway is President and Frank Westcott, Owosso, is Treasurer.

Maryville, Mo.—The Maryville Electric Light & Power Co. has increased its capital stock from $25,000 to $35,000.

Thomasville, N. C.—Thomasville Light & Power Co. has been incorporated. Capital stock is $25,000; J. W. Lambeth is interested.

St. Paul, Neb.—S. B. Knudson has purchased local electric light plant.

Stella, Neb.—Stella Electric Light Co., recently awarded contract for city lighting, will at once erect a plant.

Reno, Nev.—The Lower Truckee Electric Co. has been incorporated with a capital stock of $50,000 by T. W. Haines, of Oakland, Cal. W. H. Hall, of Gridley, Cal., and Henry W. Esden, of Reno.

Newcomerstown, O.—The Newcomerstown Light, Heat & Power Co. has increased its capital stock from $25,000 to $100,000.

Rawson, O.—The Village Council has taken steps to light the streets of the town by electricity.

Shattuck, Okla.—The Shattuck Electric Light Co. has increased its capital stock from $3,000 to $15,000.

Shawnee, Okla.—Independent Light & Power Co. has been incorporated. Capital stock is $100,000 and J. W. Rubey, Homer Alexander, Harry Mead are interested.

Mitchell, S. Dak.—The Mitchell Illuminating & Power Co., of this city, has been organized and will improve electric light plant.

South Pittsburg, Tenn.—City is reported to have sold its electric light plant to Prof. D. A. Tate, who will install new machinery.

Aberdeen, Wash.—The Grays Harbor Power & Lighting Co. will erect a new power house.

Spokane, Wash.—The Multnomah Mining, Milling & Development Co. is planning the construction of a power plant to cost about $10,000.

Fayetteville, W. Va.—Fayetteville Water & Light Co. is being organized and has applied to city for a contract to construct and operate electric lighting and power plant, water works and gas works.

Sewers.

Items Arranged Alphabetically by States.

Cicero, Ill.—Arrangements have been perfected by the Village Board and the Board of Local Improvements of Chicago, whereby the sewer in 52d Ave., Chicago, will be extended from Madison St. to the drainage canal, draining Austin and Cicero. The extension will cost $250,000 and will be built by the Sanitary District of Chicago.

Galesburg, Ill.—Council Committee has been appointed to consider establishment of septic tank sewage disposal system for purification of matter emptying into Cedar Fork.

Angola, Ind.—Construction of a 30 in. pipe sewer on South Wayne St. is under consideration. L. E. Smith is City Engineer.

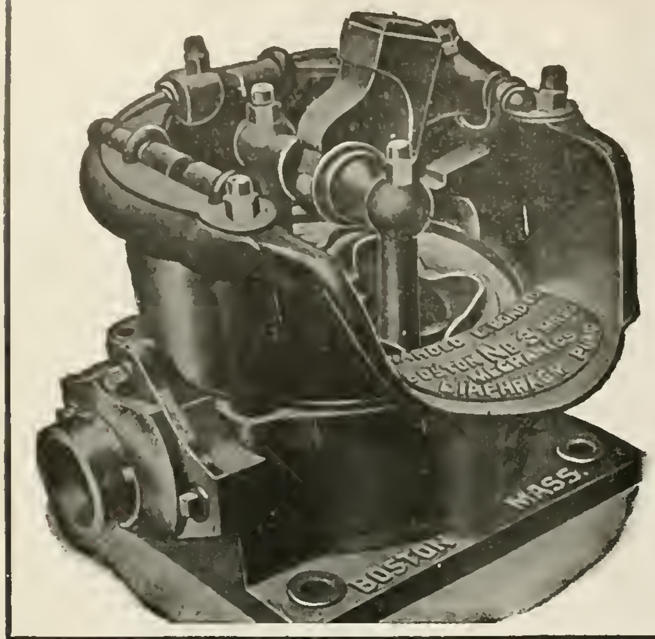
Churubusco, Ind.—Town Board plans to make a 2,500 ft. extension to sewer now under construction here. E. K. Strong, Columbia City, Ind., is Engineer.

Indianapolis, Ind.—Plans for a 2 1-3 mile sewer in 26th St., have been submitted to Board Public Works. Sewer will cost $25,000 and part of it will be 3 ft. in diameter constructed of brick or concrete. Blaine H. Miller is City Engineer.

Wellington, Kan.—Plans for sewer system for this place are practically completed and bids for construction will be asked soon.

Meriden, Miss.—Council Sewer Committee has been instructed to get estimates on cost of establishing sewer system in the cotton mill district. System would cost about $7,000.

Richmond, Mo.—This place has voted



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against establishing sewer system. Vote was about 4 to 1 against proposition.

Kansas City, Mo.—Mayor H. M Beardsley has requested Board Public Works to secure data regarding the rebuilding of the city sewer system.

St. Joseph, Mo.—Ordinance will come before Council calling for a bond issue of about $325,000 for extending sewers. David Lawlor is City Engineer.

New Philadelphia, O.—State Board of Health has approved plans for a $100,000 storm and sanitary sewer system for this city.

Hartwell (P. O. Cincinnati), O.—This place has voted against issuance of $70,000 of bonds for installing sewers. Hartwell Improvement Association will probably now take steps to secure a system on the property assessment plan.

Hudson, O.—It is stated that proposition is to be made to this place for the installation of sewerage, water works and electric light plant. Proposition is to be made on same basis as was the Ellsworth proposition. A. A. Augustus, Cleveland, O., and A. H. Pittrick, Hudson, have been empowered to carry out the provisions of the offer.

Marion, O.—Residents of West Marion have asked City Council to have constructed a sewer to extend from Center St. to Silver St., along the line of old Goose Creek. Work would cost about $5,000.

Chester, Pa.—Advices from this place state that new sewers are contemplated in Upland Borough.

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TRUNK SEWER AND TUNNEL.

White Plains, N. Y., Oct. 10, 1907.
Office of the Commission, No. 2 Grand St.

Pursuant to the provisions of Chapter 646 of the Laws of New York, 1905, as amended by Chapter 747 of the Laws of 1907.

SEALED BIDS, addressed to the Chairman of the Bronx Valley Sewer Commission and accompanied by a certified check for at least five per cent of the amount of security required for the faithful performance of the contract for each section bid upon, will be received up to November 7, 1907, at one-thirty P. M., for furnishing all the work and materials necessary for the watertight and enduring .

CONSTRUCTION of each one of the seven sections which together comprise about twelve miles of circular sewer from three and one-third to six feet in diameter and about three miles of circular lined tunnel mostly six and one-half feet and eight and one-half feet in diameter. The material to be either monolithic reinforced concrete, reinforced concrete blocks or brick masonry.

PLANS and specifications may be seen at the office of the Commission. The Invitation to Contractors, the Form for Bids, the Specifications and the Form of Contract and Bond may be obtained from the Secretary of the Commission upon the payment of one dollar, to be repaid when the same are properly used in bidding.

FORM OF BID must fulfill the requirements of the Invitation and be made out upon the printed Form of Bid as above obtained and the Commission reserves to itself the right to reject any or all bids or to accept that one or those whose acceptance will, in its judgment, best secure the public interest and the efficient performance of the work mentioned.

FRANK N. GLOVER,
Secretary.

Office of the Commission, No. 2 Grand St., White Plains, N. Y., October 10, 1907.

Postponement of Date.

The time for opening of bids for the construction of the Bronx Valley Sewer is extended to Wednesday, November 27, 1907, at 1:30 p. m., at No. 2 Grand St., White Plains, N. Y.

19-3t FRANK N. GLOVER, Secretary.

U. S. ENGINEER OFFICE, Portland, Oreg., Nov. 20, 1907. Sealed proposals for construction of one stern wheel steamboat will be received here until 11 A. M., Dec. 20, 1907, and then publicly opened. Information furnished on application. S W. Roessler, Lt. Col., Engrs. 21-4t

MUNICIPAL CIVIL SERVICE COMMISSION,
299 Broadway.
New York, October 31, 1907.

PUBLIC NOTICE IS HEREBY GIVEN that applications will be received from THURSDAY, OCTOBER 31, UNTIL 4 P. M., WEDNESDAY, NOVEMBER 27, 1907, for the position of

TOPOGRAPHICAL DRAFTSMAN.

The examination will be held on Thursday, December 19, 1907, at 10 a. m.

The subjects and weights of the examination are Technical, 5; Experience, 2; Mathematics, 2; Neatness, 1.

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The provision of clause 12 of Rule VII., to the effect that "no person who has entered any examination for appointment to a competitive position and failed therein or who has withdrawn therefrom, shall be admitted within nine months from the date of such examination to a new examination for the same position," is waived so far as it applies to this examination.

For further information apply to the Secretary.

19-3t FRANK A. SPENCER, Secretary.

SEALED PROPOSALS will be received at the office of the Light-House Engineer, Tompkinsville, New York, until 1 o'clock p. m., Dec. 16, 1907, and then opened, for furnishing two fourth order lanterns for Honolulu Range Light-Stations, Hawaii, in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to the Light-House Engineer, Tompkinsville, N. Y. 21-3t

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CIVIL ENGINEERING DRAFTSMAN, Texas, with consulting engineering firm handling municipal, hydraulic and sanitary work are wanting to get in touch with good draftsman who can carry on work of this nature and do designing from pencil notes. W. 8409, The Engineering Agency, Inc., Chicago.

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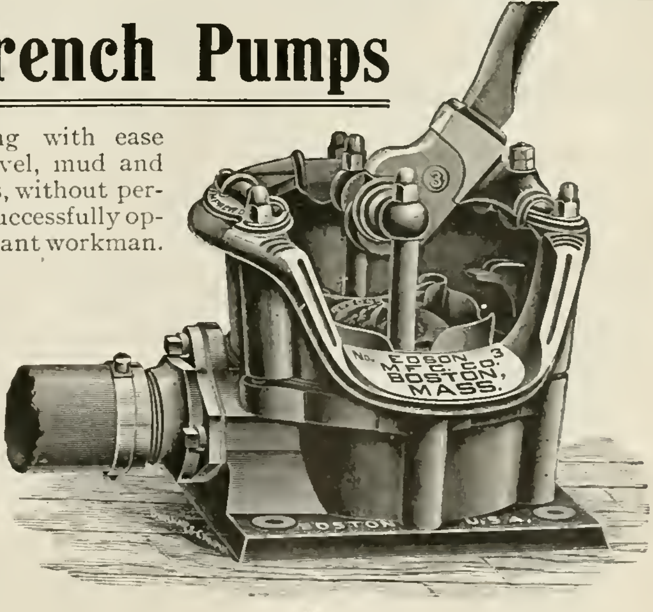
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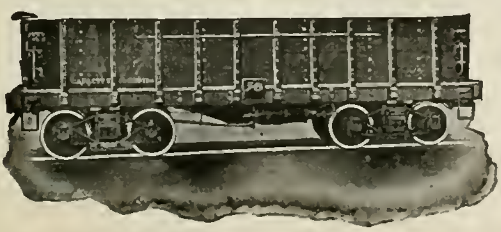

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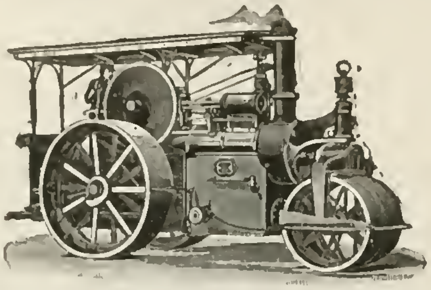

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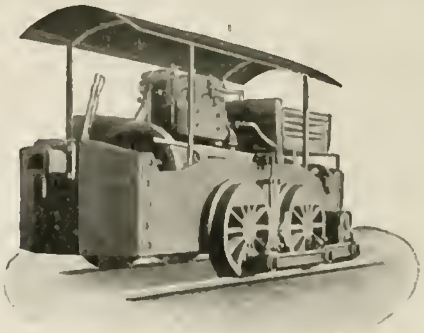

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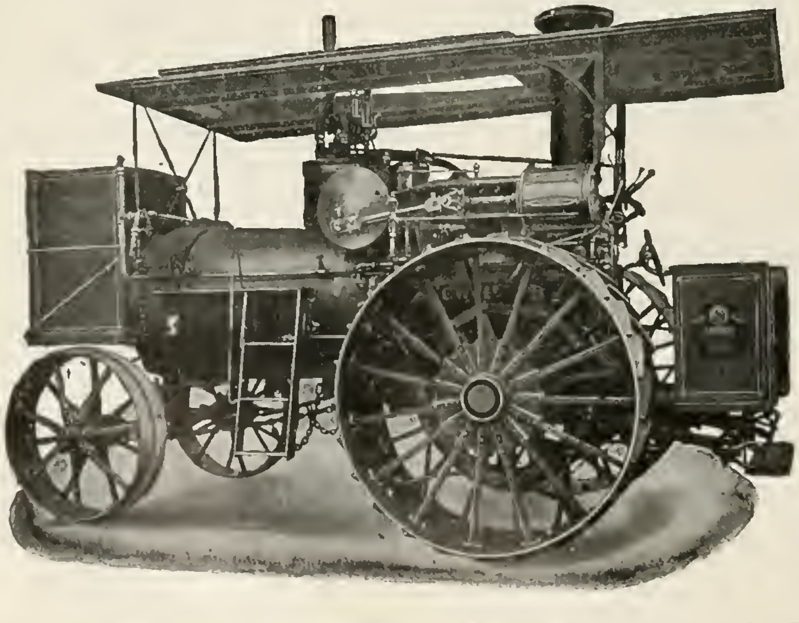

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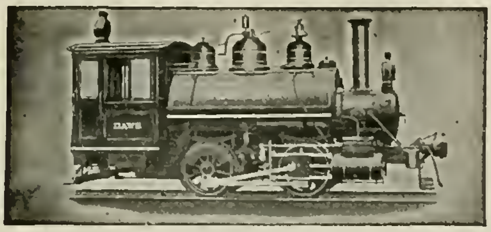

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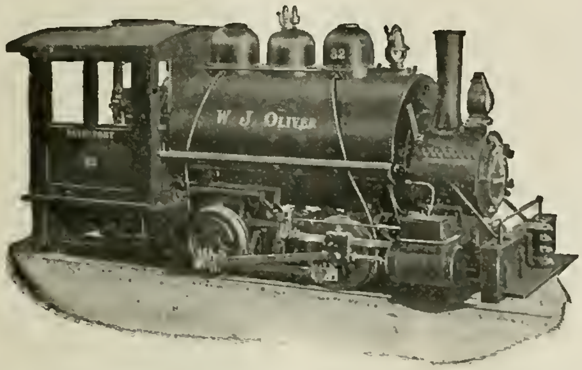

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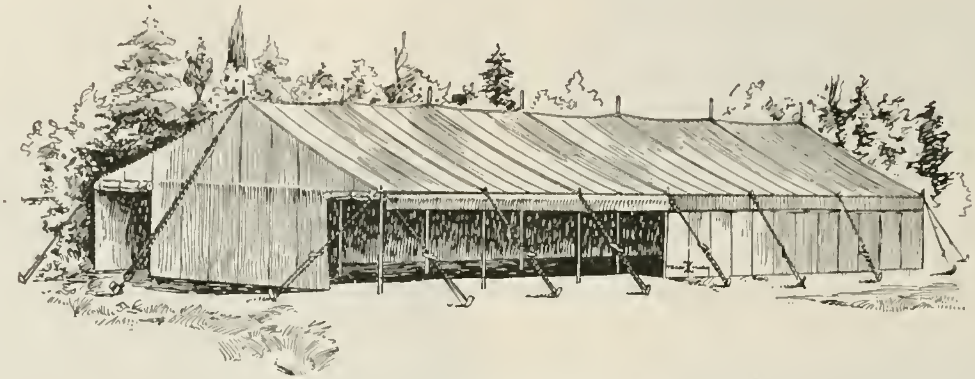

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A Noteworthy Article on the Methods and Cost of Rock Excavation.

In our earth and rock section of this issue we print an article on the methods and cost of making open railroad cuts in granite and trap rock on the Grand Trunk Pacific Ry. The information was furnished us by Mr. Geo. C. McFarlane, an engineer and contractor.

The article is worthy of note for several reasons, and shows a very careful and close study made by Mr. McFarlane of the simple operation of rock excavations. He gives records of many details of this sort of work that have never before appeared in print. Some of these details may, at first sight, appear unimportant, but they really supply the necessary data for so conducting the work as to secure economic results.

The details of springing the rock point to the way of drawing up rules that can be put into the hands of foremen for their guidance.

The use of derricks for loading rock in the cuts is a commendable method, and we hope in a future issue to give some additional costs on this part of the work.

The pole tracks used on this work are shown to be economical and can readily be built by any contractor at small costs. Two of the editors of this journal have used this system of conveying rock to the dump with great success.

The comments made by Mr. McFarlane on various features of rock drilling and excavation show that he has made such a study of the work as to reduce it almost to a science. For example, in the springing of holes he makes certain observations when he begins his work in order to obtain the ratio of the charge needed for successive springs, instead of making successive guesses, which may not give the desired results.

Mr. McFarlane is to be commended for his excellent work of observing and recording these important features of rock blasting. His work stamps him as above the ordinary observer and it means that his labors as a contractor and engineer are bound to bring him greater profit in the future by knowing such details of cost. He does a good service both to himself and the construction work in making his records of methods and costs public.

Notes on the Economies of Concrete Pile Foundation Work.

A practical contractor's experience in constructing concrete pile foundations is recorded by Mr. Charles R. Gow in another column of this issue. We believe that this record should be read by every contractor for concrete work. Mr. Gow has a strong admiration for the utility of the concrete pile but an admiration tempered with recognition of the faults and limitations of that very useful foundation device. In this regard he is exceptional among current writers who, when they express any opinion at all, damn the concrete piles with faint praise or else extol it far beyond its just merits. Laying aside preferatory comments, there are one or two points made by Mr. Gow that seem to us to be worthy of particular emphasis and also one or two thoughts suggested which it may not be wholly a waste of time to outline.

One of the most familiar arguments in advocacy of the economy of concrete piles is the argument that one concrete pile will take the place of several wooden piles. The fact is, other things being equal, that a concrete pile must replace several wooden piles if it is to compare with them in economy, since pile for pile the concrete pile costs more to make and drive. A concrete pile can, however, replace several wooden piles only when the conditions are such that its greater ability to withstand load can be utilized. When we substitute one pile for three or four we increase the unit load on the soil three or four times and we can do this only when the soil will safely support the greater unit pressure. This is the first important point made by Mr. Gow in his paper and it is one that must not be lost sight of.

The second point made by Mr. Gow, which we shall note here, is that it is a matter almost of necessity in cast pile work to know the depth of penetration of each pile and to mold the pile to correspond. The task of cutting off a pile that is too long is a troublesome and expensive one. On the other hand Mr. Gow gives some very encouraging demonstrations of the possibility of splicing out piles that are too short. He likewise shows that cast piles will stand, in some cases at least, very hard driving. Of the various other practical points in concrete pile work we shall let the paper speak for itself, excepting only one which is the method of molding cast piles.

The general practice in America has been to mold piles horizontically on the ground. This is the method described by Mr. Gow with no noteworthy future except the one that the necessity of a solid molding platform or base was demonstrated. European contractors have a strong preference for vertical molding. They believe first of all that a pile better able to withstand the strain of driving is so produced. Such lamination as results from tamping and settling is, in vertical molding, in planes normal to the axis of the pile and the line of driving stress. How much real force there may be in this line of argument we shall not attempt to determine, but the fact is that for this reason among others vertical molding of piles appears to be preferred by French and German engineers in particular. Writers on concrete construction in America express generally the opinion that horizontal molding is the cheaper method, and we do not recall that this opinion has ever been prominently disputed. By the same token also it has, so far as we know, never been shown to be based on facts. Is horizontal molding the cheaper method of molding piles?

In the ordinary run of work, where comparatively few piles are to be made, it is probably cheaper to use horizontal molding, but where a large number of piles is to be made the vertical method has certain economic advantages which are worth considering. Vertical molding necessitates a tower or staging to support the forms and for handling and placing the concrete. We imagine that the contemplation of this rather imposing structure has been a strong factor in prejudicing American engineers against vertical molding. To counterbalance this staging horizontal molding necessitates a molding platform of very solid and rigid construction if it is

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to endure continued and repeated use. In cost such a platform will not fall much below a staging, capacities being the same.

In the matter of space occupied the tower or staging has the advantage. A tower 40 ft. square will give ample space around its sides for 80 vertical forms for 12-in. piles and leave nearly 1 ft. of clear working space between such pair of forms. The ground area occupied by the tower and forms is 1,754 sq. ft. With the same spacing of molds a horizontal platform at least 25x160 ft. would be required for the molds for the same number of piles 25 ft. long. When space is scarce this difference cuts a big figure.

For round piles, vertical molding permits the use of sectional steel forms: horizontal forms for round piles are difficult to manage. For square piles vertical molding requires forms with four sides; horizontal forms for square piles may consist of two side pieces only, the molding platforms serving as the bottom and no top form being necessary, thus for square piles horizontal molding reduces the quantity of lumber per form by 50 per cent. The forms for piles molded on their sides can be removed much sooner than can the forms for piles molded on end, so that the form material is more often released for re-use. This again cuts down the quantity of form lumber required. The labor of assembling and removing forms is somewhat less in horizontal than in vertical molding. It is also less expensive to place the reinforcement in horizontal than in vertical molds as a rule; the placing and working of the concrete around the reinforcement is also somewhat more certain and easy in horizontal molding.

We come now to the very important matters of mixing and handling the concrete to the molds and of handling the molded piles. We believe that the prospect of elevating the concrete to the top of a tower is a thing which again has prejudiced contractors against vertical molding and with small justification. The tower structure furnishes a convenient means for supporting sand and stone bins and housing for cement and machinery. In a word the mixing plant can be installed within the tower or close to one side where a tower derrick can handle the mixed concrete direct from mixer to forms. The same derrick can handle the forms and the molded piles. Car tracks, cars, runways and wheelbarrows are thus eliminated entirely and they necessarily constitute rather elaborate systems in horizontal molding. We think that we can assert with good reason that mixing and handling concrete from mixer to molds is a simpler and cheaper proposition in vertical molding than in horizontal molding. Removing the piles from molding bed to storage piles or to pile driver requires heavy machinery in either case and we do not think that it can justly be claimed to be more expensive in one case than in the other.

Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Experience in Moulding and Sinking Concrete Piles for Foundation Work.

Economic considerations usually demand that a concrete pile shall be capable of replacing at least three or four wooden piles. To do this it must safely carry a load of approximately 30 tons. It must be borne in mind that the ground under and around the pile must ultimately carry this load, and since there is a limit to the carrying capacity of any soil, there must also be a limit to the load we can concentrate on one pile of ordinary section. For the subsoil conditions in the locality of Boston, Mass., the above load of 30 tons is probably a maximum safe limit.

In general, concrete pile construction may be divided into two classes—piles built in place and those cast and driven. Both methods possess certain advantages as well as limitations. In the first class, the inaccessibility of the space where concrete is being placed, and the uncertainty as to what takes place during and after placing the concrete, is apt to leave some doubt as to its final sufficiency. In the second class, while the quality of construction is apparent with even superficial inspection, the possible danger during driving is extremely problematic. Some of the methods which have been used by the writer, together with the reasons for their adoption, will be given:

Example I.—An outbreak of quicksand had occurred in the basement of a mill building of rather heavy construction and in a few days had so damaged one corner of the building as to necessitate tearing it down. The remaining walls were threatened and indicated some settlement. Borings developed the fact that the building rested upon a thin stratum of hard pan overlying a bed of quicksand 25 ft. in depth. Below the quicksand was a stratum of very coarse gravel charged with water under a head, the elevation of which was 14 ft. above the basement floor. It was decided to drive piles to the gravel in two rows, one inside and one outside the line of the walls, and to support the wall on needles capping the piles. Driving wooden piles was out of the question, as the headroom required for the driving would necessitate removing the floors. Also the heavy jar produced by the driving would disturb the ground and tend to further settle the walls. The following method was adopted:

Eight-inch wrought iron pipe in 5-ft. lengths was tapped down with a light hammer, the successive lengths being coupled together until the bottom section rested in the gravel. The pipe was then washed out with a water jet, thus removing all the quicksand. A 1-in. pipe perforated for 2 ft. on the lower end was then inserted and driven into the gravel for about 3 ft. Grout was forced into the 1-in. pipe, the intention being to form a ball of grouted gravel under the bottom of the 8-in. pipe and also to seal the bottom of the pipe against the inflow of water. After the grout had set, the 8-in. pipe was pumped out and filled with concrete. Two of these piles were subsequently used as a support from which to jack up some floors which had settled, and an estimated total pressure of 70 tons, or 35 tons on each pile, was applied without any measurable settlement of the piles. This method has since been used in a variety of cases, sometimes with slight modification. Its great disadvantage lies in the cost due to loss of pipe. On the other hand, it forms an exceedingly strong column, and, provided the foundation under it was sufficient, would carry tremendous loads.

Example II.—A large brick building had been originally constructed with the outer walls supported on piles and the inner partition walls resting on mudsills. These interior walls settled until the floors were in an unsafe condition and repairs imperative. In this case the underlying soil was a 15-ft. layer of black mud and filling overlying blue clay. Old walls and timbers in the filling admitted tide water freely, so that an open excavation would require steam pumping, with the consequent danger of removing much of the mud, thus producing further settlements. The pipe method as used in the former occasion was inapplicable, since the clay bottom would take no grout and the piles would have a bearing equal only to the area of the pipes. Figured on this basis, an excessive number of pipes would be required. This condition led to the invention of the chambering sys-

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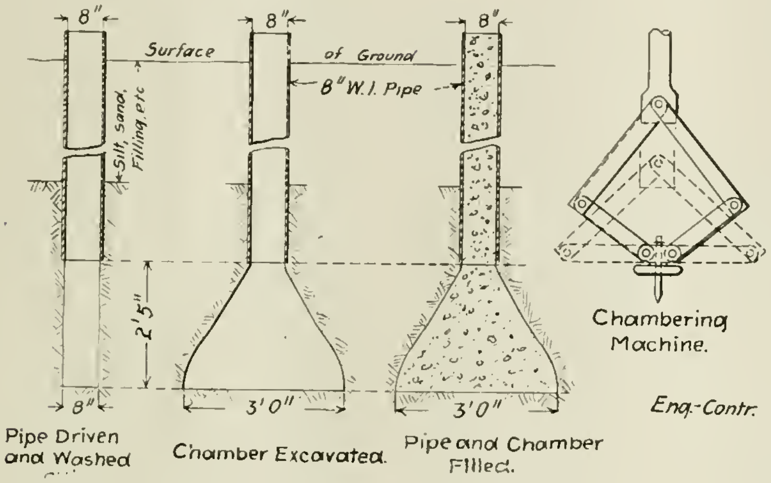
[*] Abstract of a paper read by Mr. Charles R. Gow, before the Boston Society of Civil Engineers on May 15, 1907, and printed in the journal of the Association of Engineering Societies for October, 1907.

tem, shown below. Eight-inch pipes are driven as before about 1 ft. into the clay and washed out. The washout drill is allowed to excavate for a further distance of 2.5 ft. below the bottom of the pipes and is then withdrawn. An expanding cutter of simple construction is lowered to the bottom of the pipe so as to rest in the clay below its bottom. By revolving the cutter, a circular chamber is formed 3 ft. in diameter on the base, and in shape approximately a frustum of a cone. The chamber and pipe are then filled with concrete. The result is a concrete shaft resting on an enlarged base. While we usually recommend leaving the pipe in, we have also on many occasions withdrawn the pipe as the concrete filling progressed. This system has been found particularly useful in inside work, although we have employed it in many cases in the open where it seemed to offer advantages.



Sketch Showing Method of Constructing Pile With Enlarged Footing.

Example III.—Some time later the use of these chambered piles was suggested in the building underpinning operations connected with the construction of the Washington St. tunnel, Boston. It was thought, however, that they were unsuited for this purpose since they would be subjected to lateral pressure during the period of adjacent excavation. As the practicability of the washout method is limited to pipe sizes up to about 14 ins. in diameter, a very small section would be available to resist this lateral thrust. To meet this requirement the chambered pipe system was abandoned in favor of the caisson method, similar to that in common use in Chicago. (See Engineering-Contracting, Nov. 21, 1906, for full description of caisson foundations for the Cook County Court House, Chicago, Ill.—Editors) during the past ten years, although at the time the idea was original so for as we were concerned.

By means of this method a pile of any diameter from 3 ft. upward may be constructed in the following manner: A circular excavation of the required diameter is started from the surface by means of pick and shovel. When the excavation has progressed a few feet in depth, a cylindrical steel lining in two halves is inserted and the halves are bolted together. This forms a lining which maintains the shape of the hole and protects the workman. As excavation proceeds, additional layers of steel lining are lowered to the workman, who inserts them under the first lengths and bolts them together. The sections of linings, being in two halves, are easily passed up and down through the shaft. When excavation reaches clay or other firm material, a chamber may be excavated to any reasonable diameter. The whole excavation may then be filled with concrete, the steel lining being removed, section by section, as the concrete rises in the shaft. In sections where the ground penetrated is too unstable to stand at all, as in the case of running sand, the lining is made of a series of whole cylinders about 6 ft. long each, but of varying diameters to allow each successive length to telescope through the previous section and to penetrate 6 ft. in advance of it. This type of pile has proved remarkably economical and practical for heavy concentrated loads. We have on one occasion constructed a 15-ft. diameter chamber under a 3-ft. shaft excavation. The required diameter of the chamber, of course, depends upon the total load to be carried and the unit-bearing capacity of the soil. A caisson pile having a 3-ft. diameter shaft and a 9-ft. diameter chamber in good clay is safe for a load of 250 tons. The chief advantages are the minimum of excavation required, absence of concrete forms, and the consequent increase of progress.

Example IV.—By far the most interesting case of concrete pile work yet handled is that of the Milton car barn foundation for the Boston Elevated Railway. The site of the work, covering a little less than an acre, is one of the most peculiar ground formation ever met with in our experience. Surrounded on all sides by ledge, the lot itself is a deep deposit of semi-fluid mud and quicksand extending to a maximum depth of 40 ft. The mud and sand are interspersed with what appear to be floating masses of hard pan, and at times beds of gravel overlying the quicksand are encountered. There seems to be no particular order or relation between the different classes of ground, and to further complicate matters the ledge bottom itself is so irregular that variations of 10 ft. in depth sometimes occur in a few feet distance. As the entire ground is thoroughly saturated with water, wooden piles would have been sufficient except for the possibility of future drainage if the ledge divide was ever penetrated. Concrete piles built in place were considered dangerous on account of the extreme depth and the unstable surrounding soil. The only alternative was the driving of cast piles, and this was the system finally adopted. Soundings were made at the location of each pile. A 0.5-in. gas pipe was coupled to a water hose fed by city pressure and jetted down to ledge. In this manner the exact depth from the surface of the ledge was determined for each location and a pile was cast and numbered to correspond.

The proposed building covers an area of approximately 37,000 sq. ft.; 414 piles are required, ranging in length from 1.5 to 40 ft. All piles up to 6 ft. are built in place in a wooden form. A low wall of concrete capping the outside lines of piles supports the building walls, while interior loads are, for the most part, carried on columns resting on a single pile. Each interior pile is capped with a block of concrete 2 ft. square, in the top of which is set a dowel to take the wooden column. To prevent any lateral motion in the soft mud, the original plans contemplated the use of concrete tie beams in four directions. Owing to the difficulty of trenching for the beams in the semi-fluid mud, and the absence of any foundation on which to lay the concrete, this feature of the construction was changed at our request to the use of a 6-in. slab of concrete covering the entire lot and surrounding the pile heads. This slab rests upon a 6-in. bed of cinders overlying the mud. It is reinforced with poultry netting crossed in two directions. As the slab floats on the mud, precautions were taken to break its bond around the piles and against the walls by the insertion of tarred paper in order that it might settle evenly if at all.

The piles were cast with a square section, 13 ins. on a side, and since they were to act as bearing piles no taper was given them. The mixture was a 1—2.5—4 concrete. Clinton electrically welded wire cloth was adopted as a reinforcement, having 0.25 in. longitudinal wires 3 ins. on centers. This reinforcement was bent to such shape as to make a continuous reinforcement 2 ins. inside the face of the piles on all four sides. A line of tin speaking tube 1.5 ins. in diameter was built in at the center of the pile to admit water for jetting purposes. This tube was stopped about 10 ins. from the head of the pile and, by means of an elbow and threaded nipple, projected through the side of the pile to allow of attaching the pressure hose. The piles are handled with guyed derricks and inserted in a timber guiding frame containing a pair of driving gins. As soon as it is properly centered the jetting hose is attached to the nipple, and water, supplied by a steam pump at 100 lb. pressure, is forced through the interior tube and out of the bottom of the pile. It has sometimes been found expeditious to churn the pile up and down during sinking by means of the derrick. This action appears to thoroughly loosen the surrounding ground and allows a freer escape of the material below the pile.

As stated, at intervals all over the lot thin layers of hard pan are encountered, apparently floating in the mud and sand. It has been necessary to drive the pile through these masses when encountered. Much apprehension was felt as to the possible damage which might result from the driving of these piles. A wooden follower has been used, resting on the pile head, and a 2,800-lb. hammer dropped from as high as 20 ft. has failed to produce any apparent injury. In the case of one pile the sounding pipe used in determining the necessary length of pile had penetrated a narrow crevice between two boulders and the pile was cast to the length so found. Upon attempting to drive this pile, the space between the two boulders proved to be too small to admit it. Not knowing what the obstruction was, the foreman attempted to drive through it. Three hundred blows of the 2,800-lb. hammer dropping 12 ft. were given without appreciable penetration, and rather than cut off and waste about 6 ft. of undriven pile, it was determined to pull the pile out and replace it with a shorter one. Upon withdrawing the pile, it was found to be perfectly sound and uninjured, except that the point had been slightly worn away on each side where it had rested against the two boulders. Each pile is finally driven until it brings up firmly on the ledge.

The extreme length of many of the piles introduced the serious question of how best to handle them and avoid breakage. It was found that up to 30 ft. in length they could be picked up by the end without producing any undue strains, but when over 30 ft. they almost invariably cracked in the middle. To prevent this action, four angle irons were at first used strapped to the four corners of the pile by means of iron clamps. This method was effective, but the time required in placing and removing the irons rendered it impracticable. A simpler device was finally adopted which has allowed the handling of piles up to 40 ft. in length without damage. A long chain is used, one end being wrapped around the pile near the center, while the other end is similarly wrapped near the top end; the hook of the hoisting fall is hooked into the long loop of the chain, and as the pile is hoisted the hook slips along the chain toward the top as the pile is gradually upended. By this means, while the pile is in a horizontal position, the strain is applied almost equally at the two points of attachment and prevents undue stresses at the center of length. Once in an upright position, of course, no further precautions of this nature are necessary.

The time required in driving a pile depends entirely upon the nature of the ground penetrated. A 35-ft. pile has been put down in 9 minutes, while piles one-half that length have sometimes required 3 hours.

In some cases difficulty was encountered in maintaining the pile in exact location, due to underground obstruction deflecting its course. The maximum variation of this nature thus far noticed has been about 6 ins., and fortunately has occurred under walls where the objection is slight as compared with its possible occurrence under columns, in which case a single pile supports the concentrated load.

This work was started late in November of last year. The early and severe freezing spells of that time caught us unprepared, with the result that about 75 piles were badly frozen. A thick covering of hay proved inefficient, as did also lines of steam pipes under the hay, spaced 10 ft. apart. Many of the piles were frozen before taking an initial set, and all of them before final set. Work on casting was then suspended until a shed could be constructed in which to cast the remainder. All attempts at protecting the frozen piles were abandoned and they were left to their fate, suffering alternate freezing and thawing throughout the winter. Late in January one of these piles was sent to the Watertown arsenal, thawed out, and immediately thereafter tested for crushing strength. It failed at 60 tons, or 710 lbs. per square inch. This test was deemed sufficient by the building department to warrant the condemning of the entire lot of frozen piles, but at our request a second sample was selected at random from the frozen lot and, accompanied by one of equal length taken from the lot cast under cover, was sent to the arsenal for a second test. This time the frozen pile was allowed to remain in a warm room after thawing for about 4 weeks before testing. It failed at 236 tons, or 2,800 lbs. per sq in. The unfrozen sample failed at 241 tons, or 2,852 lbs. per sq in. It would appear, therefore, that the frozen pile recovered practically all of its strength as soon as the freezing action was permanently removed. All of this lot of piles have since been driven. In a few cases the extreme ends of the frozen piles appeared to be slightly disintegrated. In such cases we cut off the ends, exposing the reinforcement, and recast them. Some of the piles thus repaired were driven within a week without injury to the new heads. In the case of one of these piles the head was shattered when the pile was within 3 ft. of grade. A new head was cast in place, the pile allowed to stand for a week, and it was then successfully driven to grade.

Some of the piles in this work have been successfully driven through material that the 0.5-in. sounding jet penetrated with the greatest difficulty, and if tapered they could probably be driven through any material that a wooden pile would penetrate.

As the work was suspended for the winter after casting the piles, no information was obtained as to how long after casting the piles could be handled and driven. It is probable that if cast in warm weather they could be handled in two weeks without injury.

As this work was the first of its kind in this vicinity, there was no available previous experience to guide us. Consequently, as might have been expected, mistakes were made in many details.

With the idea of saving expense for forms, the ground was leveled off and covered with tarred paper on which was placed the side forms for each pile. The soil was so soft, however, that it settled under the load of the green concrete from 1 to 3 ins., resulting in a great waste of concrete and adding materially to the weight of pile to be handled.

These piles, if built as designed, weigh 175 lbs. per lin. ft., and the longest ones, therefore, weigh about 3.5 tons. It may be readily understood that the handling of such a heavy load requires extreme care at all stages of the work. Owing to the fact that the piles were cast in many instances at a considerable distance from the point where they were to be driven, much time was lost in moving them to the driver. One should attempt to so lay out the work as to bring each pile within easy reach of the driving apparatus which was to drive it.

In the case of friction piles, some knowledge will be necessary as to the ability of concrete piles to penetrate different soils. Otherwise the lengths will be very indeterminate, and much waste of material and labor must result. For such piles a slight taper will probably assist the driving through firm material.

One important point to be considered in cases where the water jet method is contemplated is the displacement of soil which takes place owing to the jet action. This displacement in such soil as mud and fine sand appears to be something greater than the actual contents of the pile. This probably does not signify that voids have been left in the ground below, but rather that the disturbed soil has been altered in density, and a resulting shrinkage or subsidence may occur in the future as the material gradually returns to its original condition. An interesting feature of the Milton work in this connection has been the tendency many times for the water from the jet to reappear, not around the pile being driven, but in some cases around some other pile already driven, or perhaps through some old test pipe hole from 50 to

100 ft. away. Meanwhile the ground in the vicinity of driving has risen from 1 to 1½ ft. in elevation.

The Cement Show.

Excellent progress is being made with the arrangements for the cement show to be held Dec. 16-21 at the Coliseum, at Chicago, Ill. The exhibit space already allotted, together with the many applications for space in the exhibit department seems to make certain that the show will be well patronized from an exhibit as well as an artistic standpoint. In addition to the usual features of the exhibit, arrangements are being made for a course of short practical lectures by men eminently fitted to enlighten the trade as well as the general public.

At the first stockholders' meeting of the Cement Exposition Co., which was organized to promote the use of cement and introduce it, through the Cement Show, the following officers and directors were elected: E. M. Hagar, president Universal Portland Cement Co., Chicago, president; N. D. Fraser, vice president and general manager Chicago Portland Cement Co., vice president; C. H. Wood, of the Wolverine Portland Cement Co., Coldwater, Mich., secretary and treasurer. Directors: Wm. Dickinson, secretary Marquette Cement Mfg. Co., La Salle, Ill.; A. St. J. Newberry, president Sandusky Portland Cement Co., Sandusky, O.; E. W. Shirk, president United States Cement Co., Bedford, Ind.; D. McCool, president and treasurer Newaygo Portland Cement Co., Newaygo, Mich.; J. U. C. McDaniel, sales manager Chicago Portland Cement Co., Chicago, Ill.; B. F. Affleck, general sales agent Universal Portland Cement Co., Chicago, Ill. Of this number the following executive committee was elected: William Dickinson, B. F. Affleck, J. U. C. McDaniel.

A new system of preventing moisture in walls of buildings, invented by a Belgian, was recently tested by the officials of Ghent, Belgium. According to report of the U. S. Consul at Ghent the experiments were started July 14 and were completed on Aug. 14. The hygrometrical degree of the air in the room, of approximately 1,200 cubic meters (42,377.3 cu. ft.), where the different experiments took place, was 83° on July 13. At that time a strong moldy smell was found to exist. The greater part of the wall was covered with saltpeter, while the floor or pavement was almost continually wet. On Aug. 13, after testing the new system 30 days, the hygrometer was found to have lowered from 83° to 60°. The walls had become completely dry and the saltpeter and smell had disappeared. The pavement was perfectly dry and remained so, while prior to these experiments it had always been found to be moist. In Belgium the normal hygrometrical atmosphere of buildings in good condition varies between 60° and 70°.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Methods and Costs of Excavating Granite in Open Cuts on the Grand Trunk Pacific R. R.

Mr. George C. McFarlane, engineer and contractor, has furnished us with the following valuable data relative to the rock excavation that he is doing as a contractor on the Grand Trunk Pacific R. R. The contract that Mr. McFarlane has covers some rock tunnel work, approaches to the tunnel, and some open cuts. In this article the work described will be limited to the open cuts and the tunnel approaches. Mr. McFarlane has recorded many details and costs of rock excavation that have never before appeared in print.

The Grand Trunk Pacific R. R. is being built from Quebec to Winnipeg by the Dominion government. The J. D. McArthur Co., of Winnepeg, have the contract for grading the 276 miles between Superior Junction and Winnipeg. The 80 miles of this division lying north of the Lake of the Woods is nearly all rock work and will cost about $100,000 a mile to grade. Nearly all the rock work is sublet out to small contractors and "station men." Practically none of the sub-contractors keep any cost data on their work. Fully three-quarters of the rock cuts are sublet to gangs of station men at prices ranging from $1.15 to $1.35 per cubic yard. The station men are charged $4.50 a week for board, $5.50 a day for a team and driver, $11.50 a box for 60 per cent dynamite and $2.75 a keg for black powder and other supplies in proportion They are also given free cars and rails, but no overhaul, or, if they use pole tracks and stone boats, which they furnish themselves, they are allowed the customary 1 ct. per cu. yd. per 100 feet as overhaul beyond the 500-foot limit.

The rock cuts are 20-ft. bottom, sloped back 3 ins. to the foot, but most of the cuts break wider than the slope stakes, the overbreak running from 10 to 40 per cent. Overbreak is usually paid for at the same price as the regular section, but the commission leave it to the division engineers whether the contractor shall be allowed overbreak or not.

One gang of 10 station men took out a 7,000 yd. rock cut last winter at $1.20 per yd. and each man cleared over all expenses, $4.60 per day and board. Most of the station gangs do not make over $2.50 to $3.00 per day, and received from $1.30 to $1.35 per cu. yd.

The large cuts are mostly sublet to contractors who furnish their own equipment and camp outfit. They receive from $1.40 to $1.50 per cu. yd. All blasting material is bought from the general contractor at the following prices: Dynamite, 40 per cent, $9.00 per box; 50 per cent, $10.00; 60 per cent, $11.00; black powder, $2.50 per keg; fuse, 90 cts per hundred ft.; caps, 90 cts. per box; lead wire, $1.75 per hundred ft.; electric fuses, $3.00 per hundred for 4 ft. and $.50 per hundred extra for each 1 foot over 4 feet.

On his own work Mr. McFarlane used steam drills in all the large cuts, while in the smaller cuts hand drills were used. With hand drills, holes as deep as 30 ft. were put down. Steel 1 in. in diameter was used to make the drills, which were gaged to 1⅜ in. This size drill being used for the entire depth of the hole. The hand drillers worked 3 men in a gang. In starting the hole, and until it reached a depth of about 6 ft., 2 men did the striking and one man held the drill. In drilling holes to a greater depth all three men used striking hammer, the rebound and jumping of the drill turning it enough to keep the hole fairly round. The rocks encountered on this work are hard granite, traps and diabase of the Laurentian and Huronian system.

Hand drillers, when working by the day, were paid $2.25 for 10 hours, but, when paid per foot drilled, received 45 cts. This price per ft. does not include sharpening or carrying steel to the shop. In drilling block holes, every hole less than 1 ft. in depth was counted as being a foot.

The following are some records of hand drilling:

One gang of three men, in drilling 10 to 14-ft. holes in dark hornblende, averaged 29 ft. per day.

In drilling red granite, 20 ft. is about the average per day.

In trap and diabase rock, 18 to 19 ft. is an average day's work.

In drilling block holes, a less number of feet are drilled per day. A record for six days for one gang on block-hole work was: Monday, 1 hole 36 ins. deep; 1 hole 45 ins. deep; 8 holes from 5 to 12 ins. deep; total driven, 11 ft. 7 in. Tuesday, 1 hole 22 ins.; 1 hole 18 ins.; 4 holes 6 to 9 ins; total, 5 ft. 11 ins. Wednesday, 1 hole 36 ins.; 1 hole 22 ins.; 1 hole 17 ins.; 5 holes 6 to 12 ins.; total, 9 ft. 9 ins. On Thursday the drilling done was for holes to square up bottom of cut, there being 5 in all; 1 hole was 68 ins.;

1 hole 50 ins., 1 hole 24 ins., 1 hole 40 ins.; 1 hole 28 ins.; total, 17 ft. 6 ins. On Friday 11 holes from 6 to 16 ins. were driven. Saturday, 1 hole 44 ins.; 1 hole 30 ins.; and 7 holes from 6 to 9 ins.; total, 10 ft. 3 ins. This gives a total of 62 ft. 8 ins. in 49 holes, or an average depth of about 15 ins.

For sharpening the steel a blacksmith and a helper were employed, and a "nipper" to carry the steel back and forth from the cut and shop. For sharpening the steel for 5 gangs of drillers, who put down 2,142 ft. in a month, we have the following cost:

Blacksmith, 25 days at $3.50	$ 87.50
Helper, 24 days at $2.00	48.00
Nipper, 24 days at $2.00	48.00
12 sacks coal	12.00
	$195.50

This means an average cost of sharpening per lineal ft. of hole drilled of about 9 cts.

This gives us a total cost of drilling and sharpening drills for the examples given as follows:

Dark hornblende (deep holes) 29 ft. drilled per day—

Drilling, per ft.	$ .23
Sharpening, per ft.	.09
Total, per ft.	$ .32

Red granite (deep holes), 20 ft. drilled per day—

Drilling, per ft.	$ .34
Sharpening, per ft.	.09
Total, per ft.	$ .42

Red granite (shallow block holes), 10 ft. 3 in. drilled per day—

Drilling, per ft.	$ .65
Sharpening, per ft.	.09
Total, per ft.	$ .74

Trap and diasbase (deep holes) 18 to 19 ft. drilled per day—

Drilling, per ft.	$ .35
Sharpening, per ft.	.09
Total, per ft.	$ .44

Average of 5 gangs, 18 ft. drilled each day—

Drilling, per ft.	$ .37
Sharpening, per ft.	.09
Total	$ .46

This gives an average of 19 ft. at a cost of 47 cts. per lin. ft. for drilling and sharpening steel. This includes both deep and shallow holes.

For other costs of hand drilling see Engineering-Contracting, Oct. 2, 1907, page 197, where the cost of drilling and sharpening drills for sandstone drilling is given, and also page 199 of the same issue, on which is listed the cost of drilling in mica schist. Still more data will be found in Gillette's "Rock Excavation."

The steam drills used in the large cuts worked for the most part on deep holes. Comparatively small steam drills (all 3½-in. cylinder and less) were used. With a 3-in. machine, holes were drilled to a depth of 25 ft., while holes from 30 to 35 ft. were sunk with 3¼ and 3½-in. machines.

For conveying steam from the pipes to the drills, "Flexible Metallic Tubing," sold by the Canadian Rand Co., of Montreal, Canada, was used exclusively. With this all-metal hose, the oiler is placed at the end of the steam pipe, to lubricate the hose as well as the machine. When several drills are run from the same boiler, a sight-feed lubricator is placed on the main steam pipe, thus saving the runner the bother of oiling, and insuring a regular and continuous lubrication of the hose and machines.

This hose is made of steel or copper. It has been used for a year and a half on the Canadian Pacific and the Grand Trunk Pacific. Mr. McFarlane states that it is greatly superior to any make of rubber steam hose. The life of this metallic tubing, he says, is 6 months as compared to 2 months for the best grades of rubber hose. One piece of hose he used continuously from Nov. 15 to August 1. He paid $19 for a 25 ft. length of 1-in. hose with spuds and couplings and $23.75 for the same length of 1¼-in. hose. Using this hose allows of running up the steam pressure for deep hole drilling and also for work during freezing weather. At a temperature of 45 deg. below zero, drills were run at a distance of from 500 to 600 ft. from the boiler.

For deep holes the drill steels are made up for 2-ft. depths. The starters are gaged 3½ ins., the gage being dropped ⅛ to 3-16 in. for each succeeding steel so as to finish the hole to about 1¼ in. The bits are forged with long, heavy shoulders and very little clearance to reinforce the corners of the cutting edge and prevent excessive wear in the gage. The last two or three drills of the set are usually fitted with blunt chisel bits.

The cheaper grades of drill steel are used almost exclusively; the high grade brands of bar and cruciform steels require to be forged and dressed at low heat; and, even when properly dressed and tempered, wear as fast as the low priced drills. The latter, while they can be forged at a much "softer heat," will not stand excessive upsetting, and it is often good practice to weld on short lengths of heavy steel to form the bit.

In tempering, the bit should be toughened by heating to a bright red heat, then plunged into the water ⅝ to ¾ in. and held there 15 to 20 sec., soused a few times until the part out of the water is cooled sufficiently to show no color, and finally immersed in the tub until cold. If tempered in this manner a drill will show ½ in. of cutting edge, with a fine gray temper backed by softer tough metal.

Steam drill runners are paid $3.75 per day of 10 hours and helpers $2.25. On railroad work the cost of running steam drills is necessarily high, as, ordinarily, only one or two drills can be operated from one boiler.

The daily expense of working one steam drill from a boiler was as follows:

1 day drill runner	$ 3.75
1 day drill helper	2.25
1 day fireman	2.50
½ day blacksmith	1.87
½ day blacksmith helper	1.13
1 cord wood	2.25
Coal	.30
Repairs and oil	.38
Total	$14.43

The average number of feet drilled a day was 30 ft., making a cost, including sharpening, of 48 cts. per ft.

Some individual records of drills were as follows:

A baby Rand drill 2¼-in. cylinder put down 5 "pop holes," totaling 26 ft. 5 ins. in 5 hours.

A 3½-in Rand drill put down 4 18-ft. holes in medium hard dark granite in 10 hours, a total of 72 ft.

A 3⅛-in. Rand drilled 2 25-ft. holes in black granite and bands of hard red granite in 10 hours. All of these include time of setting up the machine and blowout the holes.

For a 3⅛-in. drill working consecutively in one cut the following record was kept for 3 days.

1 hole 17 ft. 6 in. drilled in	7 hrs.
1 hole 18 ft. 6 in. drilled in	8 hrs.
1 hole 16 ft. 10 in. drilled in	4 hrs.
1 hole 11 ft. 8 in. drilled in	5 hrs.
1 hole 16 ft. 6 in. drilled in	5 hrs.
1 hole 13 ft. 8 in. drilled in	3 hrs.
Total, 64 ft. 8 in drilled in	32 hrs.

This is an average of 2 ft. per hour.

These records are all very low, and are due, no doubt, to the hardness and toughness of the rock, and also to the fact that all these holes are 15 ft. or more in depth, thus being classed as deep holes, while the drills are all comparatively small ones, and were not designed to carry such heavy steel. For a 3⅛-in. drill to put down holes 25 ft. deep means to retard the speed of the drill exceedingly. Then, too, with these deep holes it must be remembered that the diameter of the holes is large for a greater depth than for shallow holes.

The above cost of 48 cts. per ft. is for one drill run from a boiler. To add another machine run from the same boiler would mean to reduce this cost about 10 cts. per ft.

On most open cut work it has been the custom to drill the blast hole on or near the center line of the cut, so as to get the charge of explosive at the center of the mass to be moved. A 12-ft. hole is given a 12-ft. burden, while a 25-ft. hole is given from 20 to 25-ft. burden. But Mr. McFarlane writes that with a 20-ft. roadbed he prefers two holes 10 ft. on each side of the center line, the burden not to exceed 15 ft. Holes should not be over 25 ft.

deep, nor set back more than 14 or 15 ft. If cuts are deeper than this they should be made into two lifts. Figs. 1 and 2 show arrangement of holes used by Mr. McFarlane. He writes that he finds that excessive burdens are the cause of most blasting troubles.

After drilling, the bottom of the holes are chambered to receive the charge by springing with dynamite. In a bottom bench where a heavy lift is required, no more than a foot is chambered. In upper benches it is permissible to chamber 2 or 3 ft. of the hole. If the tamping stick shows that the hole has been filled for 8 or 10 ins. with dynamite at the bottom, it may be expected that the chamber will be 1 ft. deep, while a 12 or 15-in. rise of the tamping stick will show a chamber of 2 to 3 ft.

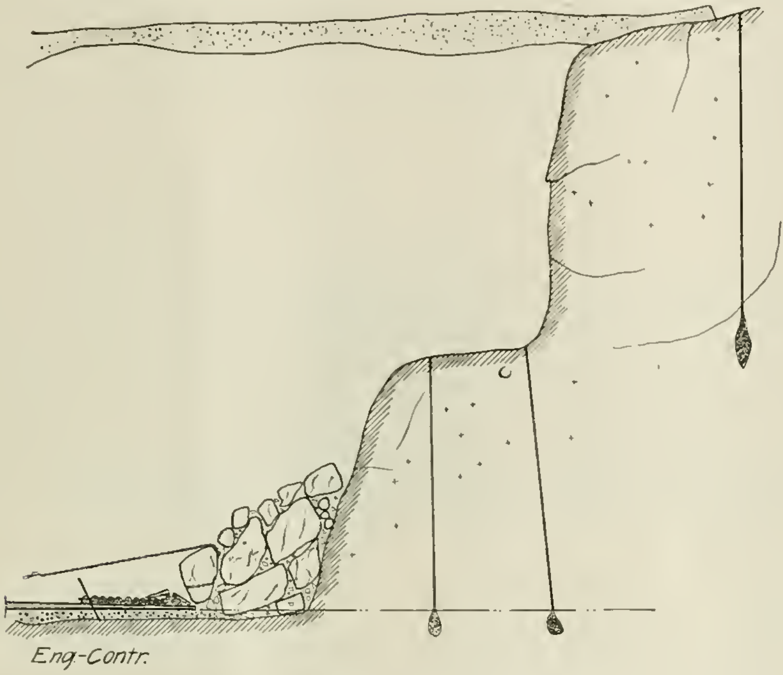


Fig. 1. Longitudinal Section of Cut Showing Blast Holes and Method of Mucking With Stone Boat and Team.

The first springs are held down by water tamping. In springing, water tamping is nearly as good as sand, except when charges of over 30 sticks are used. With heavy charges the water tamping permits the dynamite to shake up the hole and make it ragged. Sand tamping has to be drawn after each shot. If the sand is free fram clayey material it can be drawn quickly by spudding it with a churn drill and pumping up the cuttings. Sometimes it can be blown out with the steam blowpipe.

With water tamping a cap and fuse are used, unless the hole is ragged, when the spring is made with electric exploders. The fuse, usually 12 in. long, after being split is held under water for 5 or 6 seconds to kill any fire hanging in the tape, and then dropped into the hole. Unless the drop fuse were dipped in water, it might ignite dynamite adhering to the sides of the hole, causing a premature explosion. After each water-tamped spring, the hole is blown out with steam or pumped out with a sludge pump. Usually two or three water-tamped springs will be used. The succeeding springs and final charge are tamped with sand and detonated with a battery. In water-tamped spring the tamping is always blown out even if the hole is full of water; while 7 or 8 ft. of sand-tamping is seldom blown out, unless the rock is very tough, and the bottom of the hole is right in the center of a solid mass of rock having no parting planes or seams. For further information on water-tamping, see Gillette's "Rock Excavation—Methods and Costs," page 131.

Two exploders are always used in a hole, as it would be exceedingly hazardous to draw the tamping in case of a misfire. Such mishaps are exceedingly rare with a battery. Usually the spring will not throw the tamping out of the hole if more than 6 or 7 ft. of sand are used.

The springing opens up the rock jointing and indicates very closely where the burden of the shot will cleave from the solid and the successive springing charges indicate the ratio of enlargement of the pocket.

The effective force of the main blast is a short, powerful blow equivalent in length to about one-half the diameter of the powder charge. This blow is transmitted in all directions. In the immediate vicinity of the powder charge the compression is so great as to crush and pulverize the rock. As it expands toward the free faces its energy becomes absorbed by the elasticity of the rock, and the recoil from the compression throws the rock out. The jointing in the material rock materially influences the results of the heavy blast. Large irregular jointing, such as is found in the granite where quartz and feldspar predominate, causes the most trouble.

The heavy springing opens up the jointing and the blocks shift irregularly on the bed planes, often completely closing off the drill hole. Here is one great advantage of machine-drilled holes, for, owing to their greater diameter, they permit of considerable shifting before the hole is cut off. The effects of floors and slips between the explosives and the free faces is to cause the rock to cut off at one of these floors, while the rock around the explosives is merely crushed and shattered. These slips and floors deaden and deflect, or at least imperfectly transmit the shock of the explosion. On the other hand, if the slips and floors are behind and under the blast charge, the momentum of the rock ahead of the shot would tear back to these slips and floors, giving a great deal more muck than would be expected.

The slips and floors put a practical limit to the size of the blast. It was found that this limit was reached on the 30-ft. holes, burdened 15 ft., and throwing out from 400 to 800 tons of muck.

In springing, the first two springs should indicate the ratio of enlargement of the pocket. That is, should the first spring of 2 sticks occupy 10 ins. of the lower part of the hole, and should next spring of 6 sticks occupy 10 ins. of the hole, the ratio of the charge is 3 to 1. If previous experience has shown that 150 sticks per 100 cu. yds. of rock throws a nice shot, and the hole being loaded is to throw 200 yds., then the blast charge would be 300 sticks. In springing this hole 12 sticks should be used on the 3rd spring, 36 on the 4th, and 100 sticks on the fifth and last spring, using the ratio of 3 to 1 successively.

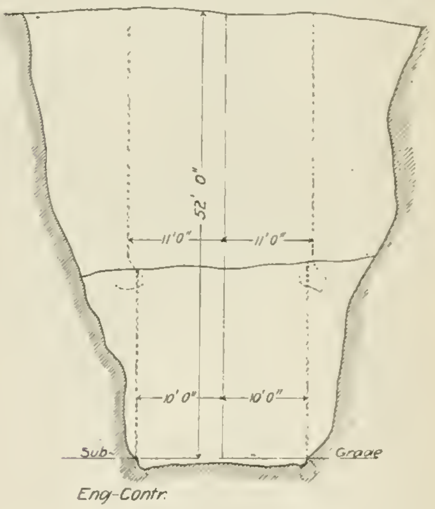


Fig. 2. Front View of Cut, Showing Arrangement of Blast Holes.

The following is the actual record of two holes sprung and shot. The holes were shot simultaneously, each being 26 ft. deep and set back 14 ft.

Hole No. 1. Springing:

6 p. m. Friday sprung with 2 sticks 60% water tamped.

8 p. m. Friday, sprung with 5 sticks 60% water tamped.

7 a. m. Saturday, sprung with 12 sticks 60% water tamped.

11 a. m Saturday, sprung with 30 sticks 60% sand tamped.

5 p. m. Saturday, sprung with 70 sticks 60% sand tamped.

Total, 119 sticks 60%.

Hole No. 2. Springing:

6 p. m. Friday, sprung with 2 sticks 60% water tamped.

8 p. m. Friday, sprung with 5 sticks 60% water tamped.

7 a. m. Saturday, sprung with 12 sticks 60% water tamped.

11:30 a. m. Saturday, sprung with 35 sticks 60% water tamped.

5:45 p. m., sprung with 100 sticks 60% sand tamped.

Total, 154 sticks 60%.

The blast was put off at 11:30 a. m. Sunday, the charge in hole No. 1 being 275 sticks, of 40% dynamite, and that in No. 2 being 150 sticks of 60% and 175 sticks of 40% dynamite. Each stick of dynamite weighed 0.35 lbs. These holes broke 450 cu. yds. of solid measurement of rock. The cost being:

Springing:	
Blasting foreman, 11 hrs. at 37½ cts.	$ 4.13
Powder monkey, 5 hrs. at 22½ cts.	1.12
Steam for blowing holes	1.50
Caps and fuse	.15
Electrical exploders	.78
88 lbs. dynamite (60%) at 22 cts.	20.68
Total	$28.36
Blasting:	
Blasting foreman, 5 hrs. at 37½ cts.	$ 1.88
Powder monkey, 5 hrs. at 22½ cts.	1.12
155 lbs. (40%) dynamite at 18 cts.	27.90
50 lbs. (60%) dynamite at 22 cts.	11.00
Electrical exploders	.52
Total	$42.42
Cost per cu. yd.:	
Drilling	$ 0.048
Springing	0.063
Blasting	0.093
Total	$ 0.204

The muck from this shot was in fine shape. Only 3 pieces required to be block holed.

The only rule for determining the amount of powder to use per cu. yd. is to measure up a good shot and divide the charge by the number of yards thrown out. This standard quantity should be varied as the slips and floors in the rock are for or against any particular shot. Mr. McFarlane states that about 0.4 lb. of 40 per cent dynamite per cu. yd. of rock is about right for the main blast, and about 0.38 lb. of 60 per cent dynamite for springing each cubic yard of rock. The average powder consumption on the Canadian Pacific double track work from Fort William to Winnipeg for the past year was 1¼ lbs. per cu. yd. Most of this was dynamite averaging 50 per cent, but some black powder and "Virite" was used.

Mr. McFarlane finds that 3 kegs of black powder are equal to 50 lbs. of 40 per cent dynamite. Neither dynamite nor black powder will throw a good shot if the rock has been shaken up too much by previous springing. With large burdens the heavy springing opens up the seams so much that excessive powder charges are required to make a shot; and the explosive is liable to kick back through a seam and leave a standing shot. The muck from a very heavy blast is usually coarse and requires much block holing and mud capping before it can be handled. It is very seldom that a heavy blast throws the rock far, the bulk of the muck being heaved 20 to 50 ft., and very rarely are any fragments thrown more than 150 ft.

The dumpman, with a tally board, kept account of the loads hauled out of the cut. He kept a separate record of the fine or shovel dirt and of the loads of large masses. After each round of blast holes was cleared up and the bottom of the cut squared up in the pop shots, the excavation was measured, and the yardage in the solid thus determined by the total number of loads hauled out, gave the number of yards to a load. In this way the amount of fine material was approximated. It was found that generally 20 per cent of the muck was shovel dirt; about 30 per cent can be lifted and loaded by the muckers; the remaining 50 per cent consisting of large blocks from 1 to 50 cu. yds. in volume. Most of these have to be broken up.

On this work two methods were used to break up boulders, namely, block holing and mud capping. Undermining was tried with indifferent success.

In mud capping the rule followed was to use 1 lb. of 60 per cent dynamite for each cubic yard of an approximately rectangular rock.

The following are three examples of the cost of block holing boulders:

Example I:

A red granite boulder 10 x 12 x 9 ft., containing 36 cu. yds., cost:

1 48-in. drill hole	$2.50
3 lbs. 60% dynamite	.66
2 fragments requiring reblasting:	
2 8-in. drill holes	1.20
1 lb. 60% dynamite	.22
Total	$4.50

A cost of 13 cts per cu. yd.

Example II:

A red granite boulder 16 x 14 at top and 13 x 10 at bottom, 15 ft. deep, containing 92 cu. yds., cost:

8-ft. machine drill hole	$7.25
16 lbs. 60% dynamite	3.52
2 fragments requiring reblasting:	
1 12-in. hole and 1 8-in. hole	1.25
1 lb. 60% dynamite	.22
	$12.24

A cost of 13¼ cts. per cu. yd.

Example III:

A black granite boulder triangular in shape, 4 x 5 x 5—5 ft. high, containing 1 1-10 cu. yds., cost:

1 7-in. hole	$ .50
⅓ lb. 60% dynamite	.08
	$ .58

A cost of 52½ cts. per cu. yd.

For other costs of breaking boulders see Engineering-Contracting, Sept. 11, 1907, page 159, and Gillette's "Rock Excavation—Methods and Costs," pages 232-236, and 366.

In block holing, hand drilling is preferred to machine drilling, as a baby drill is more expensive to run than a gang of hand drillers. Although a baby drill will put down double the number of holes, especially if a lot of large boulders are exposed in the muck pile, when these outer boulders are broken up and the muckers commence uncovering big chunks in the interior of the muck pile, it takes too long to set up a machine, and the muck pile is liable to slide and bury the machine. In drilling plug holes to square up the bottom of the cut, hand drillers can work without interfering with the teams and muckers, whereas a steam drill can only be used on the bottom when the muck is cleaned up.

The material is handled on stone boats and pole tracks and with small cars, loaded either by hand or small derricks. Stone boats running on pole tracks furnished the cheapest means of taking out rock where the haul is less than 600 ft. In winter the haul may be extended indefinitely. The track is made by laying two lines of tamarack poles 5 ft. 6 in. apart, for a two-horse team, or 3 ft. apart for a 3-horse team. In the former case both horses walk inside the pole track; in the latter case, only the middle horse walks between the poles. The poles should be fairly straight, 20 to 30 ft. long and 4 to 8 ins. in diameter. The butt end of one pole is hollowed out for a foot or so to receive the top of the next pole, and the joint fastened with a 2-in. hardwood pin. The upper part of the pole is peeled, and even joints are kept so that the track can be shifted from side to side of the fill. See Fig. 3 for construction of stone boat and manner of handling it on the dump.

The stone boats are made of 10 or 12 tamarack logs about 7 ins. in diameter and 8 ft. long, held together by two 1¼-in. hinged rods. The logs run crosswise on the pole track. Eye bolts are put in at the ends for hauling. In winter the pole track is iced and, in warm weather greased with black oil, about 1 gal. per 100 ft. being required each day. In winter a team will haul a 3-yd. rock and in summer a 1½-yd.

rock. The average load on a 6 x 8-ft. boat is about ⅞ cu. yd., weighing 4,000 lbs. On a 500-ft. haul a good team and six men will take out from 40 to 60 boats per 10-hour shift.

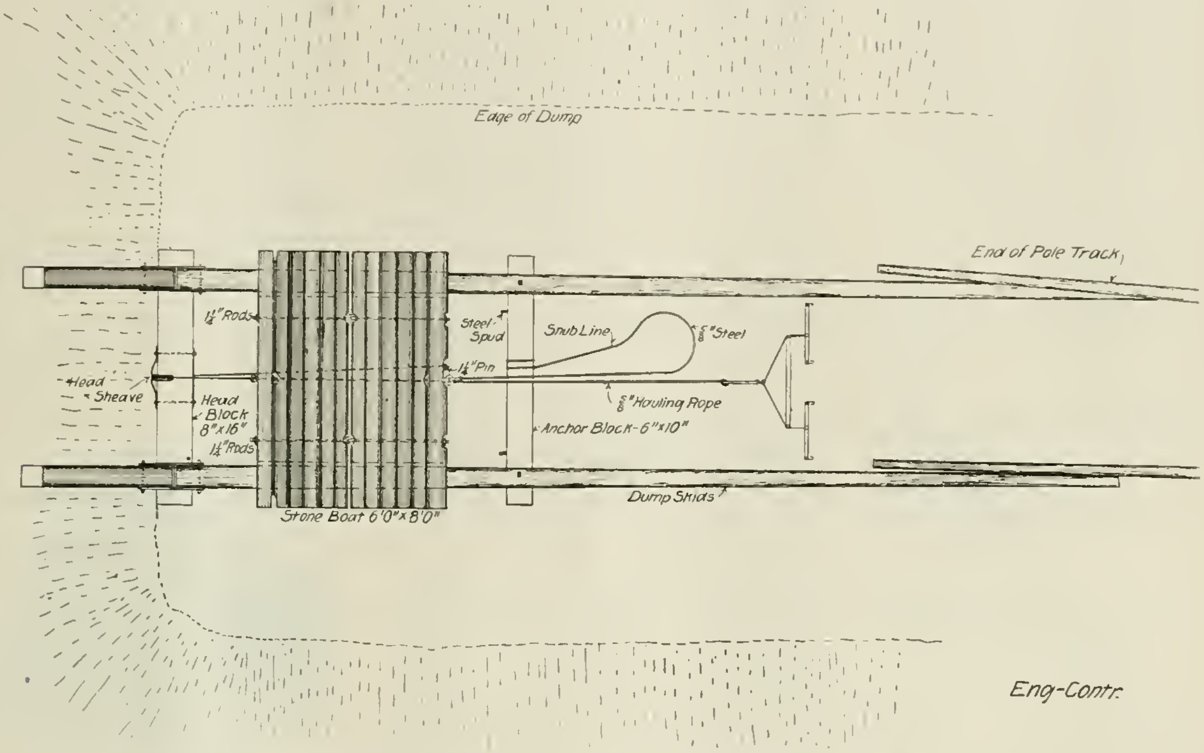


Fig. 3. Sketch Showing Arrangement for Dumping Stone Boats and End of Fill. The Dump Skids Are Shifted From Side to Side of Fill.

In excavating an approach to a tunnel of red granite, which weighs 4,400 lbs. to the cu. yd., 7,024 cu. yds. was excavated from Nov. 16, 1906, to April 24, 1907. Stone boats and pole tracks were used for this work, the average haul being 500 ft. Muckers were paid $2.00 to $2.25 per day of 10 hours; foreman, $3.75; horses cost 75 cts. per day to feed. The following was the cost per cu. yd. for excavating this 7,000 cu. yd. cut:

Drilling	$0.048
Labor, springing and blasting	0.030
Dynamite	0.024
Black powder	0.024
Wire exploders	0.008
Blasting boulders	0.104
Labor loading	0.308
Transporting	0.165
Total	$0.771

The average yardage moved per man loading was 7.3 cu. yds. per day. The cost of loading is very high, on account of high wages paid and because the large, irregular shaped masses are frequently rolled in front of the boat or to one side between the pole tracks by the loading team, and it required from 15 to 30 minutes to block hole it and get it out of the way. Where the rock is broken up in small fragments it can be loaded twice as fast.

In the other approach to the tunnel, small stiff-leg derricks were used to load narrow gaged dump cars. The cars were built on the work. The platform was 6 x 8 ft. of 3½-in. hewed tamarack plank. The wheels were 14 ins., and the gage was 30 ins. The load carried by a car varied from ¾ to 2 cu. yds. One horse pulled the cars on a 1,000-ft. haul, taking 45 loads to the dump per day.

Stiff-leg derricks were used entirely on this cut. Sometimes two ⅝-in. guy lines were put on, to steady the mast. All the wood work of the derricks was made on the ground. The derricks were used on cuts from 20 to 60 ft. deep. They were placed on the side of the cut and shifted for every 40 ft. of advance. It requires a day usually to shift a derrick. The derrick is taken down every time it is moved. A short gin pole is lashed and bolted to the top of the mast and guyed, then the stiff legs are raised clear of the center pin and lowered to the ground. The mast is then lowered with a snub line. After being moved to the new location the mast is raised with a team and blocks, the stiff legs hoisted and the boats at the end of the stiff legs ballasted with about 4 cu. yds. of rock. The wages paid to men at work on the derricks are:

Engineers	$3.00 to $3.75
Lookouts	2.25
Chainmen	2.50

They work 10 hours.

To the cost given above of 77 cts. per cu. yd. Mr. McFarlane adds 25 cts. for general expense, the charge for 7,000 cu. yds. being made up as follows:

Superintendence	$ 750
Moving outfit	200
Half cost of building camp	718
Miscellaneous expenses	75
Total	$1,743

For 7,024 cu. yds. this equals a cost of 25 cts. per unit.

The camp consisted of the following buildings, which gave accommodations for 30 to 35 men. Bunk house 22 x 32 ft., cook house 20 x 32 ft., office and commissary 16 x 18 ft., stable 16 x 20 ft., boiler house 18 x 26 ft., powder thaw house 10 x 10 ft., and blacksmith house 16 x 18 ft. These buildings were built of logs hewed on the inside, plastered inside and mossed outside. The roof of each was made of 1-in. lumber covered with rubberoid paper. The cost for the camp was:

Materials:	
Lumber, nails, roofing, window sashes	$ 440
Cutting and hauling logs	60
Labor:	
Building camp	$ 861
	$1,361
Piping up boiler and pumps	$ 75
Total cost	$1,436

In all, the buildings covered 2,808 sq. ft., making a cost of 51 cts. per sq. ft. The log huts make warm quarters for men in a cold country, but as a rule they are more expensive to build, when lumber can be bought for $20 per M or less. For the cost of buildings used for camping purpose and for small frame buildings, see Engineering-Contracting, Oct. 30, pages 251 and 252.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Data on Street Cleaning at Washington, D. C.*

The street cleaning work of Washington covers an area of 7,686,936 sq. yds. Of this amount 1,745,452 sq. yds. of paved streets are cleaned by hand patrol work; 3,245,297 sq. yds. of paved streets are cleaned by machine sweeping; 1,734,400 sq. yds. are unpaved streets; and 961,737 sq. yds. are public alleys, paved and unpaved.

The hand patrol work is done by municipal forces, a summary of the work done by them during the fiscal year ending June 30, 1907, being as follows:

Number of days worked	281
Number of men employed	189 to 215
Area cleaned, sq. yds	497,811,216
Area cleaned, miles	22,330
Debris removed, cu. yds	39.952
Bags of paper removed	56,292

The cost of the work was as follows:

	Total.	Per 1,000 sq. yds.
Labor	$82,336.91	$0.165
Materials, etc	8,338.14	.017
Total	$90,675.05	$0.182

The item materials, etc., included the following:

Purchase of bamboo, bass and blocks	$1,268.47
Purchase of bags	1,920.00
Purchase of corn brooms	108.00
Purchase of horse shoes and nails, pro rata	141.85
Purchase of forage, pro rata	3,157.18
Incidental expenses, pro rata	279.12
Miscellaneous	1,415.52
Rent of tool house	48.00

The cost of hand cleaning per cubic yard of debris removed, exclusive of waste paper, was $2.269, as against $2.091 in 1906, the increase being due to the longer haul.

The average width of the streets cleaned was 38 ft., and the cost per mile of cleaning was $4.06. A total area of 1,745,452 sq. yds. was gone over each day. The wages paid laborers was $1.50 per 8-hour day, and each laborer had an average street service area of between 9,000 and 10,000 sq yds.

The cost of street cleaning by hand patrol work in 1907 was .004 ct. per 1,000 sq. yds. greater than in 1906. The increased cost was due primarily to the longer haul for disposal of sweepings. A slight fraction of the increase also arose from the fact that in the autumn of 1906 the trees were practically denuded of their foliage within two weeks, whereas in previous years the leaf season had extended over a period of about six weeks. In order to cope with the heavy accumulation of leaves it was necessary to employ an extra force of men and vehicles.

A total of 56,292 large sacks of paper was gathered in the hand cleaning district alone, an average of 200.3 sacks per working day. Only a small proportion of this amount was taken from the waste paper boxes placed at different points throughout the business district. In order to keep the streets and sidewalks within the hand cleaning territory free of paper during the day time an average of two hours out of the eight was devoted by the laborers to picking it up. For this purpose the men were required to go over their respective sections four times per day—the first thing in the morning, before lunch, after lunch, and toward the end of the working day.

The machine sweeping of paved streets was done by contract, a summary of the work accomplished for the fiscal year 1907 being as follows:

Number of days worked	241¼
Area cleaned, sq. yds	373,029,844
Area cleaned, miles	16,733
Debris removed, cu. yds	86,814
Contract price per sq. yd	$0.22¾
Cost per mile	$5.07

The area covered by machine sweeping was as follows:

Area, sq. yds	3,245,297
Area, miles	145.6
Average width of paved street, ft.	38
Area cleaned per day, sq. yds	1,991,465
Area cleaned 6 times per week, sq. yds	737,633
Area cleaned 3 times per week, sq. yds	1,253,832

A summary of the work of cleaning the unimproved streets, consisting of rough cobblestone, macadamized, gravel and dirt roads and streets is as follows:

Number of days worked	276
Area cleaned, sq. yds	31,007,419
Area cleaned, miles	1,652
Debris removed, cu. yds	20,235
Contract price per day for full force	$73.80
Cost per 1,000 sq. yds	$0.586
Cost per mile	$11

The total area of unpaved streets was 1,734,440 sq. yds., the average width being 32 ft. A total area of 214,195 sq. yds. was cleaned each day.

The cleaning of public alleys was done by contract, a summary of the work done being as follows:

Number of days worked	250
Area cleaned, sq. yds	44,131,505
Area cleaned, miles	6,269
Average width of alleys, ft	12
Debris removed, cu. yds	12.286
Contract price per 1,000 yds	$0.40
Cost per mile	$2.816

The total area of alleys (paved and unpaved) was 961,737 sq. yds.

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*From the report of John T. Twohey, Superintendent Street Cleaning Department, for fiscal year ending June 30, 1907.

A Small Locomotive for Heavy Hauling.

The accompanying cut shows a small locomotive adapted to heavy hauling for contractors, brick yards, quarries, mines, or in fact anywhere hauling on rails is required. The locomotive is operated by gasoline fuel and can be arranged to use kerosene by the use of a special vaporizer which can be attached. The locomotive is of heavy and substantial design, having its frame of cast iron arranged to be adapted to any gage of track by wider or narrower end pieces and longer or shorter axles. The driving wheels are secured rigidly to the axles and have crank pins and counter balance similar to a regular type steam locomotive. The motor is of the two-cycle reversible type and starts in either direction by the spark lever. A heavy friction clutch with renewable shoes is provided so the locomotive can be started gradually or with a jerk. The transmission is by means of bevel and spur gears which drive the crank axle arranged near one end. Side rods connect from this crank axle to the driving wheels. Brakes are arranged with a quick operating lever, and sand boxes are provided. The whole frame and mechanism are mounted on springs which eliminate all vibration. The engine can be operated at any desired speed up to the maximum of the locomotive, which in most cases for heavy hauling is 6 or 7 miles per hour. This system of transmitting power has proved to be practically "fool proof" and will withstand considerable abuse without injuring the locomotive in any way. The locomotive is made in two sizes, 1½ and 3-ton, but patterns are under way for a 10-ton size. The 3-ton size is said to be capable of hauling 100 tons on a level track and shows a draw bar pull of over 1,200 lbs. The locomotive described above is built by Termaat & Monahan Co., of Oshkosh, Wis.

Methods and Costs; Some Old; Some New.

Data on Wood Block Floors.—The greater portion of the floors of the new Government Printing Office at Washington, D. C., were finished off with hard maple blocks 2½x12x⅞ in. in size, cut with interlocking grooves and projections on the sides and near the lower faces of the blocks. In placing the blocks the fireproof floors were first leveled up with concrete, which was finished with a sanded and troweled coat of Portland cement mortar. This coat, which was applied before the concrete below began to set, was finished with as much accuracy as the ordinary cement sidewalk. The mortar was made of coarse, clear sand, and was rich in cement. After the troweled coat had thoroughly set, it was prepared by giving it one coat of bituminous varnish; the blocks of wood were then dipped so as to coat the lower side with hot bituminous mastic, and applied to the varnished concrete. Considerable care was required to lay them accurately; the work had to be outlined and a few guide blocks carefully set, first of all. The blocks gave some trouble, due to absorption of moisture and swelling. The bituminous varnish and mastic used on the work had a good deal of coal tar in them, and there were indications that, in places, the varnish caused a sort of deterioration in the cement, as there were a good many blocks which came loose, with a skin of mortar on the under side. In all cases the cement had parted at the limit of penetration of the varnish. On this work the laborers averaged, for the entire building, 80 sq. ft. per day. It took 565 blocks for 100 sq. ft., so that the day's work was 452 blocks. The floors were laid by contract, the contract price being 27 cts. per square foot.

Excavating for a Pier Foundation.—In the construction of a concrete pier for a railroad bridge considerale difficulty was encountered in getting the excavation down to rock.' The pier was 47 ft. high, and 24 ft. by 8½ ft. at the base, and was built practically on dry land. The excavation was carried down for a depth of about 23 ft., to the level of a sand bar, with no especial difficulty, although from the commencement of this work, the earth had shown a tendency to cave and slide. A frame 3 ft. larger than the pier was then placed in position and round piles were driven 2 ft. apart to bed rock on the outside of this frame, longitudinal sheeting being placed inside the piles as the excavation proceeded. When the water line was reached sand came in so rapidly that the placing of sheeting was abandoned, and instead small Wakefield piles were driven outside of the frame. In this way the excavation was carried on until quicksand was struck, when another line of small Wakefield piling was driven and the quicksand excavated with shovels until the sand began to cave in around the outside of the crib. The excavation was carried down to within 18 in. of bedrock, and at this point it was found that no further progress could be made against the quicksand by the preceeding method. Accordingly small cofferdams, or forms, 2x4x2 ft., were made, with open top and bottom and water tight sides, so that they could be removed easily, after the concrete inside had had sufficient time to set. These forms were placed one at a time along the outside of the neat work, allowing a slight projection of the small forms outside of the neat lines of the main forms. The forms were placed in the quicksand 1 ft. apart and worked down to bed rock by bailing out all the water and sand from inside them. As fast as one form was filled with concrete, another would be sunk, and the process repeated until the circle was completed, the 1 ft. space between the forms allowing the free flow of water and sand to the pulsometer pumps, which were located near the center of the proposed pier. The 1 ft. passageways between the small forms were closed by Wakefield sheet piling, two channels being left until later for the flow of sand and water to the pumps. The sand on the bed rock between the small forms was then cleaned out and the opening concreted. After the forms for the pier had been placed, it became necessary to build a form around the pump, in order to build up the concrete and leave the pump in a sump until the pier could be built up above the danger line. The next step was to confine quicksand and water to the sump, and this was done by means of a 6 in. iron pipe, connecting the outside passageways directly with the pump.

Hauling a Gas Main Across a River.—A 6 in. wrought iron high-pressure gas main was hauled across a river by means of a cable and a derrick boat capable of lifting 75 tons on a straight pull. The river at the point of crossing was about 2,100 ft. wide and its depth was as great as 120 ft. in places. The methods employed in making this crossing were as follows: A length of pipe about 250 ft. long was screwed together, each joint being screwed up as tightly as possible. Each coupling was enclosed in a split sleeve of cast steel about 3 ft. long and weighing about 300 lbs. The first three sleeves were screwed on as tightly as possible, and the remainder moderately tight, in order to allow some little play. The water end of the pipe was a short length with a solid coned end about 1 ft. long, having at its end an eye to which was attached the hauling end of the cable. A steel wire cable of a breaking strength of 120 tons was reeled up on the opposite of the river and its end brought across and attached to the end of the main. A fall was then attached to the cable with chain grips and hauled taut, acting as a stopper, and the cable was then unreeled to the next shackle and unshackled and led to the drum of the hoisting engine of the floating derrick. This derrick boat was securely tied to the shore and the reel secured strongly to the derrick. A deadman was constructed by digging a trench about 8 ft. long and parallel to and about 250 ft. from the shore line, and putting in it two pieces of 8x16 in. timber. A second trench was dug toward the river and a short cable passed around the timber and the ends clamped with special cable grips. A second short cable was hitched to the first and taken along the trench to the waters edge and a large snatch block attached. When everything was ready the cable was passed through the snatch block as a fair lead to the drum of the windlass and the signal given to haul. When the end of the first 250 ft. length had been pulled to the water edge, an additional length were screwed on and the hauling continued. The first hauls were comparatively easy, but some obstructions near the shore on the pipe line side made it necessary to use a luff on the cable. This was hitched on to the cable with a chain grip and taken to the bitt and a rope taken around the gypsy on the windlass and hauled in. As the length of the pipe line in the water increased the pull became heavier. The cable was then stopped and the snatch block taken from the end of the line on the deadman. The line was shortened in until about 200 ft. from the bank of the river, and an extra 22 in. 2-sheave block hooked on. A second 2-sheave block was also gripped on the cable. A cable was then used on these large blocks, and the hauling part leading from the fixed block was taken down to the windlass through the snatch block, the position of which had been reversed. The cable was then hauled in. When the luff came two blocks, the large block was hauled back for the new pull by the gypsy. The total working time of connecting and pulling the pipe into the water was about 32 hours.

A company has recently been formed in Bombay, with a capital of $7,500,000, for the purpose of constructing in India blast furnaces, open-hearth steel furnaces, rolling mills, coke ovens, and other plants necessary for the manufacture of pig iron, steel rails, bars, plates, etc., and to acquire mining rights over very valuable and large deposits of iron ore. The works are to be erected at Sini Junction, on the Bengal-Nagpur Ry.

Density of Bitulithic and Asphalt Pavements.*

BY J. W. HOWARD, B. L., C. E.†

It is an axiom in many branches of engineering that density increases the stability and durability of structures. This applies to pavements which must resist pressure and attrition of that which comes in contact with them. The density resists the effects of traffic and weather in proportion to the degree of density a pavement possesses. The pressure and shock of wheels of vehicles and hoofs of horses are best resisted by a concentrated dense mass. This applies to each kind of pavement and helps not only to determine what kind of pavement will best resist a known or estimated quantity and weight of traffic, but also helps determine which one of the various grades or densities of each kind to specify and accept. It helps us select the best blocks among any of the following groups: granite, basalt, trap, wood, brick or asphalt blocks.

Density is a very important quality in all composition pavements, laid in monolithic or sheet form, such as asphalt, bitulithic, etc. That which is densest (other elements, as proper materials, mixtures, etc., being equal) is to be preferred. This is illustrated by the fact that the natural bituminous limestone or rock-asphalt pavement of Europe is denser, closer grained and more durable than many but not all of the artificial asphaltic sandstones which are the principal asphalt pavements laid in American cities.

Let us consider a certain Baltimore bitulithic pavement made of crushed stone so graded in sizes and assembled by mixing that a very small per cent of the volume is unfilled voids. I found a specific gravity of a large piece cut from the pavement to be 2.69, whereas the solid stone of the same kind as the crushed stone in that pavement had a specific gravity of 2.96. The pavement is a small fraction (9 per cent) less in density than the stone which is its principal element. The first is the specific gravity or density of the pavement as laid. The second is the specific gravity of the mineral (stone) used in that pavement. The asphalt pavements of the United States, as laid, vary in density or specific gravity between about 1.90 to 2.24, whereas the density of their largest elements, sand and limestone dust (exclusive of voids) is between about 2.60 and 2.70. These pavements are therefore 16 per cent to 23 per cent, on an average about 20 per cent less than the density of their principal mineral elements.

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[*] Brief abstract of paper read at the convention of the American Society Municipal Improvements, Detroit, Oct. 2, 1907.

[†] Consulting Engineer on Roads, Streets and Pavements, New York City.

In some special speed tests being conducted near Clayton, N. J., by the Pennsylvania railroad, a steam locomotive traveled a mile at a rate of 91.6 miles an hour.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write direct to the advertisers and state that you saw the catalog mentioned in *Engineering-Contracting*. If you are in the market for tools, machinery or supplies tell us and we will notify promptly the leading manufacturers.

No. 0465. **Electric Drills.**—The Cincinnati Electrical Tool Co., Cincinnati, O.

This bulletin describes the above named company's direct current drills which have fan coolers and several other special features. A table of capacities and sizes is given.

No. 0466. **Electric Light Diffusers.** General Electric Co., Schenectady, N. Y.

This bulletin describes the concentric light diffuser made by the above named company. The device consists of a suitably designed metal diffuser attached to a lamp casing in the same manner as an ordinary reflector or shade. In place of an outer globe a screening shade is used which performs the double function of subduing the light directly under the lamp and reflecting a portion of it on to the diffuser. Some of the advantages claimed for this method of illumination are that the light is white, even, and well distributed; that it does not tire the eyes; that the illumination is particularly adapted to the matching of colors, and that the nature or color of the ceiling does not affect the character of the illumination. Inverted diffusers have been designed to meet the demands which exist for a reflector producing a more concentrated illumination, and are used without the lower screening shades. The bulletin gives a partial list of the many installations in department stores, factories, machine shops, armories, public halls, colleges, etc., where the apparatus is in use, and includes some important data on the subject of arc lighting.

No. 0467. **Drills.** The Cyclone Drill Co., Orrville, Ohio.

This is a small 28-page catalogue illustrating various kinds of well drilling, prospecting, sounding, boring and blast hole machines and loaders. It also includes a complete list of publications of the Cyclone Co. covering the various machines they make, and booklets on drilling.

No. 0468. **Steel Wagons.** The Bruner Steel Wagon Co., Wapakoneta, Ohio.

This is a 10-page folder describing all steel wagons with solid steel wheels. The folder is attractively gotten up and well written, giving much valuable information regarding the use and buying of wagons, for farm, contract and trucking work. The Bruner Steel Wagon Co. have lately increased their capital stock from $50,000 to $100,000.

No. 0469. **Single-Phase Motors.** General Electric Co., Schenectady, N. Y.

The special motor referred to in this bulletin is known as the Type T S, Form K G motor. The bulletin illustrates various sizes, describes the details of construction and operation, shows forms of starting boxes, and gives a large amount of general information, useful and important to power users. The motors are adapted to the operation of all kinds of machines by the use of belts and gears, and may be directly connected to loads requiring moderate starting torque such as generators, blowers, etc. Clutch couplings and pulleys are used where the apparatus is required to be started under load. The motors are wound for standard voltages and frequencies.

No. 0470. **Drawing Materials and Surveying Instruments.** Kolesch Co., 138 Fulton St., New York.

This catalogue of 248 pages lists drawing materials, blue printing apparatus, reckoning machines, surveying and engineering instruments and field glasses. It contains a list of scientific books and is a valuable catalogue for every engineer.

No. 0471. **Asphalt Roofing.** Acme Asphalt Roofing Mfg. Co., Jersey City, N. J.

This booklet of 16 pages illustrates and describes asphalt slag and gravel roofing and asphalt roofing cement. Also paints for metals. Directions are given for putting the roofing on buildings.

No. 0472. **Valves and Meters.** Simplex Valve & Meter Co., Philadelphia, Pa.

This is an excellent descriptive catalogue of 10 pages. It describes and illustrates water meters for large pipes, controlling valves for stand pipes or reservoirs, rate controllers and loss of head gages for filters, automatic air valves for water mains, etc. The meter for large pipe is an interesting arrangement and is exceedingly well described and illustrated.

No. 0473. **Electric Locomotives.** General Electric Co., Schenectady, N. Y.

"The Electric Locomotive in Heavy Passenger and Freight Work" is the full title of this bulletin, in which is described a large number of present and proposed representative types of electric locomotives built by the company named. Sketches are given of locomotives ranging from 17 to 150 tons for all classes of service, including mining, high speed passenger, slow speed freight, mountain-grade trunk lines, etc. Electrical and mechanical data are given and characteristic curves for each locomotive are shown. A short preface briefly describes the reasons for the growing demand of electric traction, and gives interesting facts regarding the construction and characteristics of the General Electric heavy traction motors and locomotives, with figures relative to the saving effected by the substitution of electric for steam traction in both passenger and freight work. Bound in a flexible brown cover, the publication forms a ready reference book on the subject.

Personals.

Mr. B. W. Hicks has been appointed Chief Engineer of the Wisconsin & Michigan Ry., with headquarters at Peshtigo, Wis.

Mr. W. C. Steele has resigned his position as City Engineer of Ocean Park, Cal., and will engage in general engineering work.

Mr. J. M. R. Fairbairn has been appointed Divisional Engineer of the Eastern Division of the Canadian Pacific Ry., with headquarters at Montreal.

Mr. W. F. Barclay has been appointed Division Engineer of the Albany Division of the Boston & Albany R. R., with headquarters at Pittsfield, Mass.

Mr. Wm. A. Gilbert, of 828 Dawson St., The Bronx, New York City, has been appointed a structural steel draftsman in the Department of Bridges, New York City.

Mr. C. S. Young has been appointed Chief Engineer of the Fort Worth & Mineral Wells Interurban Electric Railroad, now under construction. His headquarters will be at Fort Worth, Tex.

Mr. W. J. Roseberry, Jr., has resigned his position as Manager with the Chicago Concrete Machinery Co. to become associated with the Chicago Builders' Specialties Co. as Manager of the Machinery Department.

Mr. William Parker, heretofore Division Engineer of the Boston & Albany R. R., at Boston, Mass., has been appointed Principal Assistant Engineer. Mr. E. A. Haskell, heretofore Roadmaster at Pittsfield, Mass., succeeds Mr. Parker as Division Engineer.

Storm Bull, Professor of Steam Engineering at the University of Wisconsin, died Nov. 18, from cancer of the stomach. Prof. Bull was born in Norway in 1856 and was educated in that country. He was the author of a number of text books on steam engineering.

Mr. L. G. Morphy, heretofore Assistant to the Principal Assistant Engineer, New York Central & Hudson River R. R., at New York City, has been appointed Assistant Engineer Maintenance of Way and Construction of the Boston & Albany R. R., with headquarters at Boston, Mass.

Mr. Frederick G. Myhlertz has resigned his position as Engineer of Construction to the Bureau of Building Inspection, of Philadelphia, Pa., and will become associated with Scott, Mitchell & Co., Philadelphia, bankers and fiscal agents of the Seaboard Portland Cement Co., who are now erecting a plant at Catskill, N. Y.

Mr. A. L. Hertzberg, heretofore Engineer of Maintenance of Way of the Canadian Pacific Ry., with headquarters at Montreal, has been appointed Divisional Engineer of the Ontario Division, with headquarters at Toronto, Ont. The office of engineer of maintenance of way has been abolished, and the duties of that position will be assumed by Mr. F. P. Gutelius, Assistant Chief Engineer, with headquarters at Montreal.

The following officers for the ensuing year were elected at the recent annual convention of the American Institute of Architects held Nov. 19-21, at Chicago, Ill.: President, Cass Gilbert, New York; First Vice-President, John M. Donaldson, Detroit, Mich.; Second Vice President, William A. Boring, New York; Secretary and Treasurer, Glen Brown, Washington, D. C.; Directors: Frank Miles Day, Philadelphia; R. Clipston Sturgis, Boston; George Cary, Buffalo.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED

Bridges.

Nov. 29. Cincinnati, O. ....Nov. 13
Nov. 29. Portland, Ore. ....Nov. 6
Nov. 29. Bethlehem, Pa. ....Nov. 6
Nov. 29. Spokane, Wash. ..:.........Nov. 20
Nov. 29. Pottsville, Pa. ....Nov. 20
Nov. 29. Atlantic, Ia. ....Nov. 27
Nov. 30. Emporia, Kan. ....Nov. 20
Dec. 2. Bucklands, Mont. ....Nov. 27
Dec. 2. Fort Worth, Tex..........Nov. 27
Dec. 3. Paoli, Ind. ....Nov. 20
Dec. 3. Petersburg, Ind. ....Nov. 27
Dec. 3. Hartford City, Ind. ....Nov. 27
Dec. 3. Council Bluffs, Ia..........Nov. 27
Dec. 4. Newport, Ind. ....Nov. 20
Dec. 4. Muncie, Ind. ....Nov. 20
Dec. 4. Fargo, N. Dak..............Nov. 27
Dec. 5. River Falls, Wis...........Nov. 27
Dec. 9. New York, N. Y...........Nov. 27
Dec. 10. Jackson, Minn. ....Nov. 20
Dec. 11. Houston, Tex. ....Nov. 27
Dec. 14. Norwood, O. ....Nov. 27
Dec. 18. Cleveland, O. ....Nov. 27
Jan. 7. Castle Haynes, N. C.......Nov. 20
Jan. 7. Salem, S. Dak..............Nov. 27
Feb. 13. St. Charles, Mo............Oct. 30

Buildings.

Nov. 27. Fort Mackenzie, Wyo.....Nov. 6
Nov. 27. Washington, D. C........Nov. 6
Nov. 27. Nashville, Tenn. ....Nov. 13
Nov. 27. New York, N. Y..........Nov. 20
Nov. 29. Marion, Ind. ....Oct. 30
Nov. 29. New Albany, Ind.........Nov. 6
Nov. 29. Oakmont, Pa. ....Nov. 13
Nov. 29. New Albany, Ind. ....Nov. 13
Nov. 29. Pottsville, Pa. ....Nov. 20
Nov. 30. Chicago, Ill. ....Nov. 20
Nov. 30. Sherman, Tex. ....Nov. 27
Nov. 30. Columbus Barracks, O.....Nov. 27
Dec. 2. Devils Lake, N. Dak......Nov. 6
Dec. 2. North Chicago, Ill.........Nov. 13
Dec. 2. Ely, Nev. ....Nov. 13
Dec. 2. Fort Worden, Wash.......Nov. 20
Dec. 2. West Newton, Mass.......Nov. 27
Dec. 2. Hoxie, Ark. ....Nov. 27
Dec. 3. Nevada, Mo. ....Oct. 30
Dec. 3. Tempe, Ariz. ....Nov. 13
Dec. 3. Allentown, Pa. ....Nov. 20
Dec. 3. Allentown, Pa. ....Nov. 27
Dec. 5. Waldoboro, Me. ....Oct. 30
Dec. 7. Remsen, N. Y..............Nov. 13
Dec. 9. Wernersville, Pa. ....Nov. 6
Dec. 9. Los Angeles, Cal..........Nov. 20
Dec. 9. Pulaski, Tenn. ....Nov. 20
Dec. 9. Chicago, Ill. ....Nov. 20
Dec. 9. Cincinnati, O. ....Nov. 27
Dec. 10. Canton, S. Dak............Nov. 13
Dec. 10. Alpine, Tex. ....Nov. 13
Dec. 10. Mobile, Ala. ....Nov. 13
Dec. 10. Jacksonville, Fla. ....Nov. 13
Dec. 10. Chattanooga, Tenn. ......Nov. 27
Dec. 12. Whipple Barracks, Ariz...Nov. 20
Dec. 16. Pulaski, Tenn. ....Nov. 27
Dec. 17. Detroit, Mich. ....Nov. 6
Dec. 17. Pawnee, Okla. ....Nov. 13
Dec. 19. Ocala, Fla. ....Nov. 13
Dec. 19. Dayton, O. ....Nov. 27
Dec. 21. Fort Worth, Tex............Nov. 27
Dec. 23. Ann Arbor, Mich..........Nov. 6
Dec. 23. Fort Des Moines, Ia.......Nov. 27
Dec. 27. Tulalip, Wash. ....Nov. 27
Dec. 27. Tulalip, Wash. ....Nov. 27
Dec. 30. Lancaster, Pa. ....Nov. 13
Jan. 2. Flint, Mich. ....Nov. 13
Jan. 2. South Bend, Ind...........Nov. 20
Jan. 3. Albuquerque, N. Mex......Nov. 20
Jan. 6. Wichita, Kan. ....Nov. 27
Jan. 8. Fort Spokane, Wash.......Nov. 27
Jan. 10. Cheyenne Agency, S. Dak..Nov. 27

Roads and Streets.

Nov. 27. Kansas City, Mo..........Nov. 20
Nov. 27. Ottawa, Ill. ....Nov. 20
Nov. 29. Logansport, Ind. ....Nov. 6
Nov. 29. Bloomington, Ill. ....Nov. 27
Nov. 30. Kansas City, Mo..........Nov. 20
Nov. 30. Greencastle, Ind. ....Nov. 20
Dec. 2. Lebanon, Ind. ....Nov. 13
Dec. 2. Sullivan, Ind. ....Nov. 20
Dec. 2. Salem, Ind. ....Nov. 20
Dec. 2. Columbus, Ind. ....Nov. 20
Dec. 2. Milwaukee, Wis. ....Nov. 27
Dec. 2. Kansas City, Mo..........Nov. 27
Dec. 2. Cincinnati, O. ....Nov. 27
Dec. 3. Monticello, Ind. ....Nov. 6
Dec. 3. Monticello, Ind. ....Nov. 20
Dec. 3. McKeesport, Pa. ....Nov. 27
Dec. 3. Portland, Ind. ....Nov. 27
Dec. 3. Martinsville, Ind. ....Nov. 27
Dec. 4. Logansport, Ind. ....Nov. 20
Dec. 4. Hartford City, Ind.........Nov. 27
Dec. 4. Des Moines, Ia............Nov. 27
Dec. 4. Brooklyn, N. Y............Nov. 27
Dec. 4. Baltimore, Md. ....Nov. 27
Dec. 5. Danville, Ind. ....Nov. 20
Dec. 5. Toledo, O. ....Nov. 27
Dec. 6. Salt Lake City, Utah......Oct. 23
Dec. 7. Peru, Ind. ....Nov. 13
Dec. 10. Lebanon, Ind. ....Nov. 13
Dec. 11. Fort H. G. Wright, N. Y..Nov. 27
Dec. 11. Harrisburg, Pa. ....Nov. 27
Dec. 12. Flemington, N. J..........Nov. 20
Dec. 12. Anderson, Ind. ....Nov. 27
Dec. 13. Monticello, Ind. ....Oct. 30
Dec. 13. Harrisburg, Pa. ....Nov. 27
Dec. 14. Lebanon, Ind. ....Nov. 13
Dec. 16. Steubenville, O. ....Nov. 27
Dec. 17. Providence, La. ....Nov. 27
Dec. 20. Washington, Pa. ....Nov. 27
Feb. 4. Billings, Mont. ....Nov. 27

Sewers.

Nov. 27. White Plains, N. Y........Nov. 13
Nov. 27. Lafayette, Ind. ....Nov. 20
Nov. 27. Green Bay, Wis............Nov. 27
Nov. 28. Norfolk, Va. ....Nov. 20
Nov. 29. Lincoln, Neb. ....Nov. 27
Nov. 29. Bloomington, Ill. ....Nov. 27
Dec. 2. Cadillac, Mich. ....Oct. 23
Dec. 3. Auburn, N. Y.............Oct. 16
Dec. 3. Akron, O. ....Nov. 27
Dec. 4. Des Moines, Ia............Nov. 20
Dec. 5. McKeesport, Pa. ....Nov. 27
Dec. 5. St. Paul, Minn............Nov. 27
Dec. 6. Salt Lake City, Utah.....Nov. 6
Dec. 6. Flint, Mich. ....Nov. 27
Dec. 7. Marcy, N. Y...............Nov. 20
Dec. 9. Orrville, O. ....Nov. 27
Dec. 17. Louisville, Ky. ....Nov. 27

Water Supply.

Nov. 27. Madison Barracks, N. Y...Nov. 20
Nov. 27. Philadelphia, Pa. ....Nov. 27
Nov. 28. Fort Morgan, Ala.........Nov. 6
Nov. 28. Bloomington, Ill. ....Nov. 27
Nov. 30. Munhall, Pa. ....Nov. 27
Dec. 1. Phoenix, Ariz. ....Oct. 16
Dec. 1. Vicksburg, Miss. ....Nov. 27
Dec. 2. Phoenix, Ariz. ....Nov. 13
Dec. 9. Bay Minette, Ala..........Nov. 27
Dec. 12. Cambridge Springs, Pa....Nov. 20
Dec. 17. Camden, N. J..............Oct. 16
Dec. 19. Fort Dade, Fla.............Nov. 27
Jan. 1. Norway, Me. ....Nov. 27
Jan. 8. Tucson, Ariz. ....Nov. 27

Miscellaneous.

Nov. 27. Washington, D. C., Steamers, Nov. 13
Nov. 27. New York, N. Y., Building Scows, Nov. 20
Nov. 29. New York, N. Y., Snow and Ice Removal, Nov. 20
Nov. 29. Brooklyn, N. Y., Snow and Ice Removal, Nov. 20
Nov. 29. Philadelphia, Pa., Garbage Disposal, Nov. 27
Nov. 29. Scituate, Mass., Riprap, Nov. 27
Nov. 29. Fort Totten, N. Y., Wharf Repairs, Nov. 27
Nov. 30. Fort Caswell, N. C., Bulkhead, Nov. 13
Nov. 30. Bloomsburg, Pa., Monument, Nov. 13
Dec. 2. Washington, D. C., Tow Boat, Nov. 13
Dec. 2. Meaford, Ont., Breakwater, Etc., Nov. 13
Dec. 2. Homestead, Pa., Garbage Furnace, Nov. 27
Dec. 3. Reading, Pa., Garbage Disposal, Nov. 20
Dec. 3. Lecompte, La., Electric Plant, Nov. 27
Dec. 3. New York, N. Y., Boat Repairs, Nov. 27
Dec. 4. Altoona, Pa., Garbage Disposal, Nov. 6
Dec. 4. Danville, Ill., Telephone System, Nov. 20
Dec. 5. Edgewood, Pa., Garbage Disposal, Nov. 27
Dec. 9. Erie, Pa., Street Lighting, Nov. 27
Dec. 9. Fort Hancock, N. J., Wharf Repairs, Nov. 27
Dec. 11. Montgomery, Ala., Bulkhead, Nov. 27
Dec. 11. New York, N. Y., Water Curtains, Nov. 27
Dec. 17. Cincinnati, O., Flatboat, Nov. 27
Dec. 17. Philadelphia, Pa., Grade Crossing Work, Nov. 27
Dec. 17. Fort Hancock, N. J., Garbage Crematory, Nov. 27
Dec. 18. Madison, Wis., Concrete Work, Wrecking, Nov. 13
Dec. 20. Portland, Ore., Steamboat, Nov. 20
Dec. 20. Lafayette, Ind., Electric Lighting, Nov. 27
Dec. 21. Chinook, Mont., Electric Light Works, Nov. 20
Dec. 23. Portland, Ore., Hydraulic Dredge, Nov. 27
Jan. 14. Portland, Ore., Light Station, Nov. 27
May 1. Buenos Aires, Argentina, Subways, Nov. 20

Excavation, Earth and Rock.

Nov. 27. Anderson, Ind., Ditch, Nov. 20
Dec. 2. Trenton, Ont., Railroad Work, Nov. 13
Dec. 3. Wheaton, Minn., Ditch, Nov. 20
Dec. 3. Wausau, Wis., Drainage Ditches, Nov. 6
Dec. 6. Canton, N. Y., Ditch Work, Nov. 13
Dec. 11. Emmetsburg, Ia., Ditch Work, Nov. 20
Dec. 11. Fort H. G. Wright, N. Y., Grading, Filling, Etc., Nov. 27
Dec. 14. Boston, Mass., Dredging, Nov. 27

Materials, Machines, Supplies, Tools, Etc.

Nov. 27. Washington, D. C., Clock System, Nov. 6
Nov. 29. Kansas City, Mo., Gate Valves, Nov. 27
Nov. 29. Indianapolis, Ind., Fire Engines, Nov. 27
Nov. 30. Chicago, Ill., Electric Elevator, Nov. 27
Nov. 30. Houston, Tex., Shells, Nov. 27
Dec. 1. Phoenix, Ariz., Water Pipe, Oct. 16
Dec. 2. Vicksburg, Miss., Road Outfit, Nov. 13
Dec. 3. Hollidaysburg, Pa., Water Pipe, Nov. 20
Dec. 3. New York, N. Y., Iron Lumber, Etc., Nov. 27
Dec. 4. Minerva, O., Boiler, Nov. 20
Dec. 5. New York, N. Y., Brick, Nov. 27
Dec. 6. Washington, D. C., Pumps, Blocks, Rope, Etc., Nov. 13
Dec. 6. Brooklyn, N. Y., Crossheads, Nov. 27
Dec. 6. Washington, D. C., Telephone Materials, Nov. 27
Dec. 7. Chicago, Ill., Water Pipe, Nov. 27
Dec. 10. North Tonawanda, N. Y., Fire Hose, Nov. 27
Dec. 10. Washington, D. C., Radiators, Nov. 27
Dec. 11. Washington, D. C., Sheet Copper, Nov. 27
Dec. 13. Washington, D. C., Lumber, Angles, Etc., Nov. 20
Dec. 14. Nashville, Tenn., Lumber, Nov. 20
Dec. 16. Tompkinsville, N. Y., Lanterns, Nov. 20
Dec. 21. Washington, D. C., Dump Barges, Nov. 27
Jan. 15. Manila, P. I., Pumps and Motors, Oct. 30

BIDS ASKED

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Council Bluffs, Ia.—Until Dec. 3, by County Auditor, for construction of bridges required by Pottawattamie County.

Atlantic, Ia.—Until Nov. 29, by F. W. Herbert, County Auditor, for furnishing all material and labor and erecting complete all steel and wooden bridges that may be required by Cass County.

Hartford City, Ind.—Until noon, Dec. 3, by L. W. Daugherty, County Auditor, for labor and materials for constructing arched concrete culvert over Joe Creek Ditch, and for constructing brick, stone or reinforced concrete culvert, known as the Hart culvert.

Petersburg, Ind.—Until 2 p. m., Dec. 3, by Commissioners of Pike County, for construction of four bridges in Washington Township.

Buchlands, Mont.—Until Dec. 2, by W. R. Leet, County Clerk, Fort Benton, Mont., for constructing two bridges over Highwood Creek, near this place.

New York, N. Y.—Until 2 p. m., Dec. 9, by James W. Stevenson, Commissioner of Bridges, 13 Park Row, for the construction of the masonry piers, surface and sub-surface changes, and steel superstructure of the Manhattan and Brooklyn approaches of the Manhattan bridge, over East River, between the Boroughs of Manhattan and Brooklyn. Security required is $800,000.

Fargo, N. Dak.—Until noon, Dec. 4, by Arthur G. Lewis, County Auditor, for replanking or paving Front St. bridge and approach; also for repairing bridge in Barnes Township.

Cleveland, O.—Until 11 a. m., Dec. 18, by Julius C. Dorn, County Clerk, for constructing standard guard railing on Brecksville Road in Brecksville Township.

Norwood, O.—Until noon, Dec. 14, by L. H. Gebhardt, Clerk Board Public Service, for labor and material for the construction of the substructure of the viaduct over the B. & O. S. W. Ry. and Section Ave. Jas. A. Stewart, Engineer, 712 Traction Bldg., Cincinnati, O.

Philadelphia, Pa.—See Grade Crossing Work under Bids Asked—Miscellaneous.

Salem, S. Dak.—Until Jan. 7, by C. J. Black, County Auditor, for constructing county bridges during ensuing year.

Houston, Tex.—Until Dec. 11, by John B. Ashe, County Auditor, for constructing four bridges.

Fort Worth, Tex.—Until 9 a. m., Dec. 2, by C. J. McKenna, County Auditor, for the erection complete of one 40-ft. steel bridge on 12-ft. steel piers, resting on concrete bases, to be a 12-ft. roadway and with one 20-ft. approach, over Rush Creek, on Cotter and Collard Road, six miles south of Arlington. Each bid must be accompanied by plans and specifications in detail.

River Falls, Wis.—Until Dec. 5, by Allen P. Weld, City Clerk, for construction of a steel truss bridge 140 ft. long with concrete floor 20 ft. wide at the Cedar St. crossing of the Kinnickinnic River.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Hoxie, Ark.—Until Dec. 2,. by Geo. R. Mann, Architect, Little Rock, Ark., for erection of a school building for city of Hoxie.

Fort Des Moines, Ia.—Until 3 p. m., Dec. 23, by Capt. Jno. J. Boniface, Constructing Q. M., for constructing, plumbing, steam heating and electric wiring one double set captains' quarters and two double sets lieutenants' quarters, and constructing one quartermaster's storehouse at Fort Des Moines.

Wichita, Kan.—Until 3 p. m., Jan. 6, by James Knox Taylor, Supervising Architect, Washington, D. C., for construction (complete) of the extension to the U. S. Post Office and Court House, at Wichita.

West Newton, Mass.—Until Dec. 2, by Public Buildings Commissioner, West Newton, for installing entire electric plant in proposed technical training high school building at Walnut St. and Elm Road, Newtonville.

Cincinnati, O.—Until Dec. 9, by Dr. J. M. Withrow, Chairman Board of Education, for the various branches of work above water table necessary for the erection of a new high school building on Clifton Ave., McMillan and Guy Sts.

Columbus Barracks, O.—Until 10 a. m., Nov. 30, by Capt. H. J. Hirsch, Constructing Q. M., for construction of three double sets lieutenants' quarters (including electric wiring and fixtures), one quartermaster's storehouse and one wagon shed at this post.

Dayton, O.—Until Dec. 19, by Wm. G. Haeussler, Clerk Board of Education, for labor and material for erection of west wing of Manual Training High school building.

Allentown, Pa.—Until Dec. 3, by County Commissioners, for construction of an addition to county jail.

Cheyenne Agency, S. Dak.—Until 2 p. m., Jan. 10, by Commissioner of Indian Affairs, Washington, D. C., for furnishing materials and labor to construct a building for employes' quarters at the school at Cheyenne River Agency.

Pulaski, Tenn.—Until noon, Dec. 16, by G. H. McMillion, County Judge, for the erection of a 2-story and basement, brick and stone, fireproof Court House at Pulaski. B. B. Smith, Architect, 22½ Perry St., Montgomery, Ala.

Chattanooga, Tenn.—Until Dec. 10, by Board Public Works, for constructing new city hall.

Forth Worth, Tex.—Until 3 p. m., Dec. 21, by James Knox Taylor, Supervising Architect, Washington, D. C., for installation of plumbing, gas-piping, etc., in extension to U. S. Post Office and Court House, Fort Worth. Bids are also asked for low pressure steam heating apparatus and for installation of a conduit and electric wiring system for above extension.

Sherman, Tex.—Until Nov. 30, according to reports, by Building Committee Y. M. C. A., for brick, stone, iron and carpenter work on Y. M. C. A. building.

Fort Spokane (P. O. Miles), Wash.—Until 2 p. m., Jan. 8, by Commissioner of Indian Affairs, Washington, D. C., for labor and materials to construct two day school buildings at Nespelem and Barnaby, Colville Agency, Washington. For further information apply to Capt. J. McA. Webster, U. S. Indian Agent, Fort Spokane, Miles P. O., Wash.

Tulalip, Wash.—Until 2 p. m., Dec. 27, by Commissioner of Indian Affairs, Washington, D. C., for furnishing materials and labor to construct a dormitory, hospital, power house and electric lighting system at Tulalip School, Wash. For further information apply to Charles M. Buchanan, Superintendent, Tulalip, Wash.

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Bloomington, Ill.—Until 2 p. m., Nov. 29, by E. H. Packard, Clerk Board Local Improvements, for constructing brick pavement and combined concrete curb and gutter on Walnut St.

Anderson, Ind.—Until 2 p. m., Dec. 12, by James D. Kinnard, County Auditor, for constructing 9,140 ft. of gravel road.

Hartford City, Ind.—Until noon, Dec. 4, by L. W. Daugherty, County Auditor, for constructing three macadam roads, as follows: McColly road, 5,825 ft., in Harrison Township; Storms road, 14,472 ft., in Washington Township; Bugh road, 15,810 ft., in Washington Township.

Martinsville, Ind.—Until 2 p. m., Dec. 3, by B. E. Thornburg, County Auditor, for construction of 8,160 ft. of gravel road in Jackson Township.

Portland, Ind.—Until 2 p. m., Dec. 3, by County Commissioners, for construction of two gravel roads in Noble Township.

Des Moines, Ia.—Until Dec. 4 by Board Public Works, for constructing 3,000 sq. yds. vitrified block pavement, 962 sq. yds. asphalt pavement and 3,800 lin. ft. curb.

Providence, La.—Until noon, Dec. 17, by T. J. Powell, Mayor of Town of Providence, Parish of East Carroll, for paving and curbing for constructing 4 miles of sidewalks.

Baltimore, Md.—Until 11 a. m., Dec. 4, by Commissioners for Opening Streets, Hoen Bldg., to curb, gutter and resurface with bitulithic 22nd St. from Oak St. to Cromwell St.

Kansas City, Mo.—Until 3 p. m., Dec. 2, by Frank P. Gossard, Secretary Park Commissioners, for grading driveway in North Terrace Park.

Billings, Mont.—Until 5 p. m., Feb. 4. by J. D. Matheson, City Clerk for constructing 86,653 sq. yds. of gravel macadam; 3,000 lin. ft. of sewer, complete; 12 manholes, complete; 15 catch basins; 17,400 lin. ft. of gutter, complete. Bids are also asked for constructing 6,305 sq. yds. of shale brick pavement.

Brooklyn, N. Y.—Until 11 a. m., Dec 4, by Bird S. Coler, Borough President, for the work under seven contracts for regulating and repaving with asphalt. Largest contract calls for improvement of Irving Ave., the work requiring 11,860 sq. yds. of asphalt pavement.

Cincinnati, O.—Until noon, Dec. 2, by M. J. Keefe, Clerk Board Public Works, for labor and materials for improvement of St. Lawrence Ave. from east line of Section 6, Delhi Township, to west line of Suire Ave. by grading, setting sandstone straight curbs and granite circular curbs, paving the gutters with granite blocks, macadamizing the roadway and constructing the necessary drains, basins and retaining walls. Bond or certified check for $2,000 required with bid.

Fort H. G. Wright, N. Y.—Until Dec. 11, by Capt. Wm. E. Horton, Q. M., U. S. A., New London, Conn., for construction of macadam roads and sidewalks and for grading at Fort H. G. Wright. .

Toledo, O.—Until noon, Dec. 5, by Reynold Voit, Secretary Board Public Service, for labor and material for laying all delinquent cement concrete sidewalks and driveways and for laying, relaying and repairing all delinquent stone sidewalks and driveways for a period of one year, in three sidewalk districts.

Steubenville, O.—Until Dec. 16, by T. W. Vance, Clerk Board Public Service, for paving Market St.

Harrisburg, Pa.—Until Dec. 13, by State Highway Department, Harrisburg, for constructing a road 600 ft. long in Mechanicsburg Borough, Cumberland County, and two roads in Hampden Township, same county, 5,730 ft., and 1,520 ft. long.

Harrisburg, Pa.—Until Dec. 11, by State Highway Department, Harrisburg, for constructing two roads, 2,700 ft. long and 6,932 ft. long in Lower Mifflin Township, Cumberland County.

McKeesport, Pa.—Until 4 p. m., Dec. 3, by C. E. Soles, City Controller, for paving Scott St. with brick.

Washington, Pa.—Until noon, Dec. 20, by County Commissioners, for repair of improved roads. Wm. Wylie, County Engineer.

Milwaukee, Wis.—Until 10:30 a. m., Dec. 2, by Charles J. Poetsch, Chairman Board Public Works, for paving roadway of Reed St. with granite block and curbing sidewalk with stone.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Bloomington, Ill.—Until 2 p. m., Nov. 29, by E. H. Packard, City Clerk, for labor and materials for constructing 12-in., 15-in., and 18-in. vitrified pipe sewer in Moulton St., 12-in. pipe sewer in Clay St., and 12-in. pipe sewer in Washington St.

Louisville, Ky.—Until noon, Dec. 17, by Commissioners of Sewerage, Chas. P. Weaver, Secy., 601 Equitable Bldg., for constructing Sec. B. of southern outfall sewer contract No. 2, under recent $4,000,000 bond issue. Work includes the following: Sewer, 3,322 ft., 15 ft. 2 in. x 15 ft. 6 in.; sewer, 1,820 ft., 14 ft. 5 in. x 15 ft.; sewer, 970 ft., 13 ft. 11 in. x 14 ft. 3 in. The principal items include: Excavation 6,143 lin. ft.; depth 22 ft. to 42 ft.; concrete, 17,000 cu. yds.; reinforcing steel bars, 1,200,000 lbs.; Portland cement, 21,000 bbls. Harrison P. Eddy, Consulting Engineer, 14 Beacon St., Boston, Mass. J. B. F. Breed, Chief Engineer, Louisville.

Flint, Mich.—Until Dec. 6, by City Clerk, for constructing sewer in Lapeer St.

St. Paul, Minn.—Until 2 p. m., Dec. 5, by R. L. Gorman, Clerk Board Public Works, for constructing sewer in Erie St., from 7th St. to Grace St.

Billings, Mont.—See under Bids Asked—Roads and Streets.

Lincoln, Neb.—Until noon, Nov. 29, by Thos. H. Pratt, City Clerk, for constructing sewers in Sewer District No. 45, to cost $760.

Akron, O.—Until noon, Dec 3, by Chas. H. Watters, Secretary Board Public Service, for constructing sewer in Ploomfield Ave.

Orrville, O.—Until Dec. 9, by City Clerk, for constructing complete sewer system.

McKeesport, Pa.—Until 11 a. m., Dec. 5, by C. E. Soles, City Controller, for constructing a sewer.

Green Bay, Wis.—Until 3 p. m., Nov. 27, by F. F. Martin, Chairman, Council Committee on Sewers, for laying a 12-in. vitrified pipe sewer in Grignon St.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Bay Minette, Ala.—Until Dec. 9, by J. H. H. Smith, Clerk County Commissioners, for construction of water works for county court house, located at this place.

Tucson, Ariz.—Until Jan. 8, by Frank S.

Treat, City Clerk, for labor and material for constructing water works.

Fort Dade (P. O. Egmont), Fla.—Until 8 p. m., Dec. 19, by Constructing Q. M., for constructing three cypress cisterns at this post.

Bloomington, Ill.—Until Nov. 29, by E. H. Packard, City Clerk, for 4,000 ft. 10-in. cast iron water main.

Norway, Me.—Until Jan. 1, by Norway Water Co., for constructing 1,000,000 gallon reservoir. S. D. Andrews is President.

Vicksburg, Miss.—Until Dec. 1, by A. W. Fridge, Adjutant General, M. N. G., Jackson, Miss., for boring a 4-in. pump well, 200 to 250 ft. deep, at Vicksburg rifle range.

Munhall, Pa.—Until noon, Nov. 30, by H. I. Maclay, Borough Secretary, for constructing 2,000 ft. of 6-in. water mains.

Philadelphia, Pa.—Until noon, Nov. 27, by George R. Stearns, Director Public Works, for work under Schedule A—restoring burnt portion of testing station, cast iron force main, etc. Specifications with Chief Engineer, Bureau of Surveys, Room 410, City Hall.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

Boston, Mass.—Dredging.—Until 11 a. m., Dec. 14, by Bureau of Yards and Docks, Navy Department, Washington, D. C., for dredging in slip at navy yard, Boston, Mass.

Fort H. G. Wright, N. Y.—Grading, Filling, Etc.—Until Dec. 11, by Capt. Wm. E. Horton, Q. M., New London, Conn., for constructing timber retaining wall and for filling and grading around wharf at Fort H. G. Wright.

Philadelphia, Pa.—Embankment, Etc.—See under Grade Crossing Work—Bids Asked, Miscellaneous.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Montgomery, Ala.—Bulkhead.—Until Dec. 11, by Capt. H. B. Ferguson, U. S. Engrs., for constructing bulkhead at mouth of Appalachicola River, Florida.

Lafayette, Ind.—Electric Lighting.—Until noon, Dec. 20, by Board Public Works, for lighting city with electricity for a period of 10 years from Sept. 10, 1908.

Lecompte, La.—Electric Plant.—Mayor J. R. Moore is asking electrical engineers, contractors and others to submit plans and specifications until Dec. 3 for power house and complete electric light system. Cost must not exceed $10,000.

Scituate, Mass.—Riprap.—Until 2 p. m., Nov. 29, by Harbor and Land Commissioners, State House, Boston, Mass., for furnishing and placing in position in sea fall or Third Cliff, Scituate, about $2,000 worth of heavy riprap.

Fort Hancock (P. O. Sandy Hook), N. J.—Wharf Repairs.—Until Dec. 9, by the Quartermaster for repairs to government wharf. Capt. M. F. Falls is Constructing Q. M., at this post.

Fort Hancock (P. O. Sandy Hook), N. J.—Garbage Crematory.—Until 2 p. m., Dec. 17, by Capt. M. N. Falls, Constructing Q. M., for constructing garbage crematory at this post.

Fort Totten, N. Y.—Boat Repairs.—Until noon, Nov. 29, by Lieut. H. A. Tompkins, for repairs and alterations on U. S. torpedo planter "General Henry J. Hunt."

New York, N. Y.—Boat Repairs.—Until 11 a. m., Dec. 3, by John V. Coggey, Commissioner of Correction, 148 E. 20th St., for furnishing all the labor and materials required for making and completing the alterations and repairs to the steamer "Massasoit."

New York, N. Y.—Water Curtains.—Until 2 p. m., Dec. 11, by John H. O'Brien, Commissioner Water Supply, Gas and Electricity, 13 Park Row, for furnishing, delivering and erecting a system of water curtains, with all piping, valves, manifolds, sprinkler heads, brackets, supports and all other appurtenances, complete, in place and ready for operation in the high pressure pumping stations located at Oliver and South Sts., and at Gansevoort and West Sts., Borough of Manhattan. Security required is $1,000.

Cincinnati, O.—Flatboat.—Until 2 p. m., Dec. 17, by Lt. Col. Wm. T. Rossell, U. S. Engrs., for constructing a steel flatboat.

Portland, Ore.—Hydraulic Dredge.—Until 11 a. m., Dec. 23, by Lt. Col. S. W. Roessler, U. S. Engrs., for construction of one wooden hull hydraulic dredge. Official advertisement will be found elsewhere in this issue.

Portland, Ore.—Light Station.—Until noon, Jan. 14, by the Light House Engineer, Portland, Ore., for material, erection and construction of Hinchinbrook Entrance light station, Alaska.

Edgewood (P. O. Kittanning), Pa.—Garbage Disposal.—Until noon, Dec. 5, by O. B. Craig, Chairman Committee, for garbage disposal.

Erie, Pa.—Street Lighting. Until Dec. 9, by City Clerk, for lighting streets for term of years.

Homestead, Pa.—Garbage Furnace.—Until 7:30 p. m., Dec. 2, by Andrew Hill, Clerk, for furnishing garbage furnace.

Philadelphia, Pa.—Grade Crossing Work.—Until noon, Dec. 17, by W. Hunter, Chief Engineer Philadelphia & Reading Ry., 520 Reading Terminal, for construction of following work appurtenant to the abolishment of grade crossings on the P. G. & N. A. R. in Philadelphia: Contract No. 5—masonry, trestle and embankment from south side of Berks St. to the south side of Susquehanna Ave. Contract No. 7—masonry, trestle and embankment from south side of Susquehanna Ave. to Broad St. Contract No. 8—bridges from Berks St. to Broad St. Contract No. 14 masonry, embankment and paving for yards between York St. and Cumberland St. Contract No. 26—temporary engine yard at Wayne Junction.

Philadelphia, Pa.—Garbage Disposal.—Until noon, Nov. 29, by George R. Stearns, Director Public Works, for disposal of garbage.

Materials, Machines, Supplies, Tools, Etc.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Radiators.—Until 2 p m., Dec. 10, by Bernard R. Green, Superintendent of Construction, office of Building for National Museum, Library of Congress, Washington, for furnishing and delivering the cast iron radiators for hot water heating required for the new building for the National Museum.

Washington, D. C.—Sheet Copper.—Until noon, Dec. 11, by Elliott Woods, Superintendent U. S. Capitol Building and Grounds, for furnishing and delivering, only, at the office building, U. S. Senate, Washington, D. C., of the quantities of sheet copper called for below: 6,250 sheets 24x96 ins., equivalent to 100,000 sq. ft. of material.

Washington, D. C.—Dump Barges.—Until 10:30 a. m., Dec. 21, by H. F. Hodges, General Purchasing Agent, Isthmian Canal Commission, for furnishing under Canal Circular 404, four steel dump barges.

Washington, D. C.—Telephone Material.—Until noon, Dec. 6, by the Forester, Forest Service, U. S. Department of Agriculture, for furnishing to the Forest Service 600 miles of No. 12 B. B. galvanized iron wire, 1,200 miles No. 9 B. B. galvanized iron wire, 60,000 standard 12-in. brackets, and 60,000 standard No. 9 pony glass insulators. One-third of this material to be delivered at Denver, Colo., and the remaining two-thirds at Salt Lake City, Utah.

Chicago, Ill.—Electric Elevator.—Until 11 a. m., Nov. 30, by Wm. A. Coleman, City Business Agent, 316 City Hall, for the construction, erection and installation, ready for operation, of one electric freight elevator, in the Municipal warehouse and garage, 204-206 Michigan St.

Chicago, Ill.—Water Pipe.—Until 11 a. m., Dec. 7, by Department Public Works, 317 City Hall, for furnishing and delivering to city 5,300 tons of 6-in. to 12-in. cast iron water pipe. The official advertisement will be found elsewhere in this issue.

Indianapolis, Ind.—Fire Engines.—Until Nov. 29, by Trustees Central Indiana Hospital for Insane, for stationary chemical fire engines to be installed in buildings at hospital.

Kansas City, Mo.—Gate Valves.—Until 2 p. m., Nov. 29, by Everett Elliott, Secretary Board Public Works, for furnishing one 48-in. horizontal, double gate valve, three 48-in. vertical, double gate valves, one 42-in. vertical, double gate valve and one 30-in. vertical, double gate valve.

Brooklyn, N. Y.—Crossheads.—Until 2 p. m., Dec. 6, by John H. O'Brien, Commissioner Water Supply, Gas and Electricity, 13 Park Row, New York, for furnishing and delivering special crossheads for lamp posts in the Borough of Brooklyn.

New York, N. Y.—Iron, Lumber, Etc.—Until 11 a. m., Dec. 3, by John V. Coggey, Commissioner of Correction, 148 E. 20th St., for furnishing and delivering hardware, paints, iron, steam fittings, lumber and miscellaneous articles.

New York, N. Y.—Brick.—Until noon, Dec. 5, by W. Bensel, Commissioner of Street Cleaning, 13 Park Row, for furnishing and delivering 10,000 North River bricks (red), 8,000 square fire bricks, 5,000 end wedge fire bricks, 50 bbls. fire clay, 30 cu. yds. Cow Bay sand.

North Tonawanda, N. Y.—Fire Hose.—Until Dec. 10, by Geo. H. Smith, City Clerk, for furnishing 2,000 ft. of fire hose.

Houston, Tex.—Shells.—Until Nov. 30, by John B. Ashe, County Auditor, for furnishing 100 cars of clam or Red Fish reef mud shell for repairing county roads.

CONTRACTS LET.

The following contracts have been let recently:

Atlanta, Ga.—Interurban Railway.—Cook & Laurie Co., Montgomery Ala., for construction of Atlanta-Augusta interurban electric line. The line as proposed will be 200 miles long and work will be started at Atlanta.

Beardstown, Ill.—Bridge Work.—Fremont Bridge & Concrete Co., Fremont, Ill., for constructing two 30-ft. steel bridges and removal of one bridge.

Joliet, Ill.—Water Main, Sewer.—William Moran, at $1,030, for Glenwood Ave. water main and $686 for Campbell St. sewer.

Springfield, Ill.—Sewer.—Richard Egan for constructing 18-in. crock pipe sewer in N. Grand Ave.

Taylorville, Ill.—Bridge.—J. J. Smith, Taylorville, at $1,875, for constructing iron bridge in South Fork Township.

Bluffton, Ind.—Road Work.—County Commissioners have awarded for following road contracts: Liest, gravel road, to Neff & Ochsenrider, at $1,820; Motz, stone road, to Neff & Yarger, at $5,394; Holloway, gravel road, to J. N. Neff, at $4,753; Williams road, gravel, to Neff & Ochsenrider, at $3,807; Schwartz road, stone, to M. Alexander & Co., at $3,329; Myers, gravel road, to J. C. G. Maddux, at $3,600; Heller, stone road, to Wheat & Sisk, at $2,595; Maddux road, gravel to J. C. G. Maddux at $3,400; J. Q. Merriman road, gravel, to J. C. G. Maddux, at $1,200; Perry road, gravel, to A. P. Addington, at $1,178; Showalter, gravel road, to J. C. G. Maddux, at $1,300; J. H. Hogg, stone road to M. Alexander & Co., at $6,622.40; F. W. Hogg, stone road, to John R. Gordon, at $5,800; Carnes, gravel road, to J. N. Neff, at $2,743; Neuenschwander, stone road, to Neff & Yarger, at $5,778; Wisner road, stone to M. Alexander & Co., at $2,741.03; Quick, stone, to John R. Gordon, at $2,890.

Chanute, Kan.—Bridge.— Southwestern Bridge Co., Joplin, Mo., has been awarded the contract to build a bridge across the Neosho River near Chanute. The crossing consists of one 200-ft. span one 70-ft. span and two 30-ft. steel approaches, the roadway being 20 ft. The contract price was $11,573. Work will be completed about June 1, 1908.

Covington, Ky.—Bridge.—Oregonia Bridge Co. for constructing county bridge over Taylor Creek at Bonnie Leslie.

Williamsport, Md.—Concrete Bridge.—Coder & Miller, Harrisburg, Pa., at $103,000 for constructing concrete bridge 1,650 ft. long and 30 ft. wide over Potomac River for Washington & Berkley Bridge Co.

Ellsworth, Me.—Bridges.—Union River & Bar Harbor Power Co., at $1,900, for constructing two bridges for city.

Flint, Mich.—Sewer.—J. W. Collins, for sewer in Industrial Ave.

Baudette, Minn.—Water Works.—M. D. Stoner, Bemidji and C. W. Jewett, Blackduck, Minn., to put in water works at this place.

Grand Rapids, Mich.—Revetment Wall.—Thomas Newhof, at $1,694, for Silver Creek revetment wall.

Elizabeth, N. J.—Foundation Work.—The Foundation Co., 115 Broadway, New York, has been awarded contract for borings and for placing Simplex concrete piles in the foundations for a new refining plant for the S. T. Baker Oil Co., at Bay Way, Elizabeth, N. J. The piles are to be used in the foundations of the tanks, the walls of the filling house, storage house and tank house.

Cleveland, O.—Drainage Sewer.—Dall & Son for constructing drainage sewer at new court house. Contract amounts to about $30,000.

Girard, O.—Sewer.—C. L. Allen, Marion, O., at $20,000, for trunk line sewer. George H. Shute will be in charge of work.

Lawton, Okla.—Railroad Work.—Stebbens & Kirk Construction Co., Oklahoma City, Okla., for constructing seven mile section of the Lawton, Wichita Falls & Northwestern Ry.

Dunmore, Pa.—Sewer.—O'Boyle Bros., at $3,492, for constructing sewer in Drinker St.

Reading, Pa.—Sewers.—David Peoples, at $18,601, for constructing northwest intercepting sewer; Joseph P. O'Reilly, at $74,101, for 12th district sewers; Joseph P. O'Reilly, at $17,800, for Rose Valley sewer.

Connellsville, Pa.—Bridges.—York Bridge Co., York, Pa., for bridge over Mill Run and bridge over Meadow Run for the county.

Butler, Pa.—Roadwork.—Norman J. Boyer, Butler, for constructing state road in Butler Borough and Buffalo Township.

Dunmore, Pa.—Sewer.—O'Boyle Bros., at $3,100, for constructing sewer in Drinker St.

Harrisburg, Pa.—Sewer.—John N. McCulloch, at $981, for Pigeon St. sewer, and $931 for 12th St. sewer.

Lewistown, Pa.—Dam.—Aherns Contracting Co., for constructing dam for Raystown Water Power Co.

Lebanon, Pa.—Pole Line.—George C. Unger, S. 8th St., for erecting a pole line for a distance of about 15 miles.

Philadelphia, Pa.—Dredging.—American Dredging Co., Philadelphia, by U. S. Engineer, for dredging Delaware River at following bid: Sec. 4, 620,000 cu. yds., at 16c; sub-sec. 5A, 640,000 cu. yds., at 16c; sub-sec. 5B, 640,000 cu. yds., at 17½c.

Memphis, Tenn.—Paving.—M. Larkin, at $23,030, for paving Orleans St. with Purington brick.

Fort Worth, Tex.—Paving.—Texas Bitulithic Co., for about $240,000 worth of paving for this city.

Richmond, Va.—Bridge.—Urban & Bradley, at $1,000, for concrete bridge over North Run on Hillard's Road.

Williamsburg, Va.—Building.—George C. Ware, Newport News, Va., contract for erecting building for Female Seminary in this city.

Spokane, Wash.—Bridge.—William Oliver, at $8,500, for constructing Le Pray bridge over Spokane River. Bridge will consist of three 120-ft. spans and will rest on steel tubular piers filled with cement.

Tacoma, Wash.—Sewer.—Lister Construction Co., at $16,635, for constructing sewer.

PROJECTED WORK.

Bridges.

Items Arranged Alphabetically by States.

Oceanside, Cal.—Plans of City Engineer for bridge over San Luis River have been approved by City Trustees.

Denver, Colo.—Following bids were received Nov. 13 at State Engineer's Office for constructing bridges: Capulin, Conejos County, 50 ft. reinforced concrete—Pueblo Bridge Co., $2,800; Walter Sharp Bridge Co., El Dorado, Kan., $2,400. 30 ft. arch at Empire, Clear Creek County, C. G. Sheely, Denver, $1,949 and $1,800 for plate girder and concrete floor. Steel bridge at Iola, Gunnison County, Southwestern Bridge Co. of Denver, $4,350; Midland Bridge Co., $4,800, and Pueblo Bridge Co., $4,650. The Southwestern, Denver and Midland companies submitted bids of respectively $3,940, $4,700 and $4,767 for the construction of an 80-ft. steel bridge over the White River, one mile east of the state line in Rio Blanco County.

Atlanta, Ga.—Plans are being considered for the erection of a viaduct across the railroad tracks at Bellwood Ave.

Savannah, Ga.—Seaboard Air Line R. R. may be required by U. S. Government to remove its present bridge over Riceboro River, 20 miles from this city, and replace it with a draw bridge. Hearing in matter is to be held Dec. 18 in U. S. Engineer's Office. E. A. Frink, Portsmouth, Va., is Bridge Engineer.

Belvidere, Ill.—Following bids were received for constructing concrete bridge at Main St.: Joliet Bridge Co., $19,100; Illinois Bridge Co., one bid $13,887 and another, $14,200, according to which of two plans were adopted.

Lafayette, Ind.—Bids are to be asked shortly by the Commissioners of Tippecanoe County for the construction of a new steel bridge over the Wabash River, at Granville. The structure will be 645 ft. long and consist of three spans of 215 ft. each. The roadway is to be 16 ft. wide, two concrete abutments and two stone piers.

Port Huron, Mich.—Grand Trunk Ry. will build new steel bridge over Military St. T. T. Irvine, Detroit, Mich., is Resident Engineer, G. T. Ry.

Mankato, Minn.—The city, county and North Mankato are planning to build a second steel bridge across the Minnesota River at this point. The cost is estimated at about $20,000, and the state has appropriated $6,000.

Trenton, N. J.—Freeholders of Mercer and Burlington counties have reached agreement regarding proposed bridge over Crosswicks Creek and bids for the construction work will be asked at once.

Oswego, N. Y.—C. E. Stowell, Albany, N. Y., will prepare plans for a new bridge to replace the present lower crossing over the Barge Canal in this city.

Toledo, O.—Board Public Service has approved plans for construction of Lake Shore & Michigan Southern Ry. bridge over Swan Creek from Monroe St. to Goose Point. Bridge will cost about $85,000 and will be of Scherzer rolling lift type. Work on driving piles will begin immediately and the superstructure started in the spring. B. R. Leffler, Cleveland, O., is Engineer of Bridges, L. S. & M. S.

Troy, O.—County Engineer has been instructed to prepare estimates for proposed canal bridges at Troy and Piqua.

Toledo, O.—Board Public Service has recommended that Cherry St. bridge be improved at a cost of about $23,000.

Philadelphia, Pa.—George R. Stearns, Director Department Public Works, has recommended the construction of a number of new bridges.

Altoona, Pa.—Estimates are to be made for construction of small bridge on Monongahela Ave.

Washington, Pa.—Grand jury has approved report of viewers for erection of new bridge over Monongahela River at Monongahela. The bridge will be erected by Washington and Allegheny Counties and will cost $294,228, according to figures of Wm. Wylie, County Engineer. Grand jury has also approved building of a bridge over Mingo Creek, in Nottingham Township, also the rebuilding of the Good Intent bridge in West Finley Township.

Railroads

Items Arranged Alphabetically by States.

Fort Smith, Ark.—Midland Valley R. R., operating between this city and Arkansas City, Kan., 273 miles, is said to be planning to start work next year on an extension from the latter place to Wichita, Kan. J. H. Harris, Muskogee, Ind. T., is General Superintendent.

Santa Monica, Cal.—Advices from this place state that surveys are under way for an extension of the Malibu railroad and that the route has been staked out for a distance of 20 miles beyond the rails now down. N. S. Darlington, Manager of the Rindge Estate, is interested.

Denver, Colo.—Denver, Laramie & Northwestern R. R. has acquired 160 acres of land here for use as a terminal site. Construction of roundhouse, shops and buildings is to be started at once, it is said. John D. Milliken, Denver, is General Counsel for the road.

Brunswick, Ga.—Final arrangements are to be made shortly for the extension of the Georgia Coast & Piedmont R. R. to Brunswick, where terminals are to be constructed. L. K. Emerson, Darien, Ga., is Superintendent.

Anderson, Ind.—Project for the construction of a railroad by the American Sheet & Tin Plate Co., from Elwood to this city to connect with Central Indiana R. R. so as to have direct line into the Indiana coal field has been revived. Right of way for the road was secured and surveys made some years ago.

Providence, Ky.—Advices from this city state that surveys for a steam railway from Providence via Beulah to Dawson, Ky., 19 miles, have been completed. Grading will begin in the spring of 1908, it is said. J. T. Edwards is President and D. R. Osburn is the engineer in charge.

Cadillac, Mich.—Grand Rapids & Indiana Ry. will erect a roundhouse with a capacity of 25 engines in this city next year. The main line through the city will also be double tracked. E. H. Barnes, Grand Rapids, Mich., is Chief Engineer.

Winston-Salem, N. C.—Surveys have been completed between Statesville and Mt. Airy for the proposed Statesville Air Line R. R. R. L. Greenlee, formerly City Engineer of this place was in charge. It is probable that surveys will be made in the next few months for the line from Radford, Va., to Mt. Airy.

Edgeley, N. Dak.—Final surveys for the Midland Continental R. R., are practically completed. The road as projected is to connect this place and Jamestown. H. E. Sox, August Bradtkorb and G. F. Wesner, of Edgeley, are reported to be interested.

Oklahoma City, Okla.—Surveys are reported under way for a route for the Red River Ry. Co., which proposes the construction of a railroad from this city to Bonham, Tex., 200 miles. Construction work is to be started Jan. 1, according to a reported statement of George F. Robertson, of Watoka, Ind. T., the secretary of the company.

Oklahoma City, Okla.—With capital stock of $60,000,000 and headquarters in this city, the International & Great Southern R. R. Co., has been chartered and proposes the construction of a road southwest from Joplin, Mo., via Webber Falls, Ind. T. to Galveston, Tex., with branch lines from Webber Falls to Fort Worth, Tex., and to El Paso, Tex., a total mileage of 2,000 miles. The incorporators include: George Silsbury, Saginaw, Mich.; D. D. Klapp, M. H. Thompson, Henry Loop and John H. Surber, of Tecumseh, Okla.; L. E. Patterson, C. T. Williams and S. C. Glasgow of Oklahoma City.

Oklahoma City, Okla.—Oklahoma, Colorado & Pacific Ry. Co has been chartered with $18,000,000 capital stock and headquarters in this city, and proposes the construction of a 600 mile road northwest from Oklahoma City to Trinidad. The incorporators include Edgar Turner, Turner, Okla.; M. G. Wiley, Guymon, Okla.; H. P. Ladd, L. E. Patterson and Hobart Huson, Oklahoma City, and George Silsbury, Saginaw, Mich., the latter also being an incorporator of the International & Great Southern R. R., mentioned in the proceeding.

Lawton, Okla.—Kansas, Lawton & Gulf Ry. Co. has been chartered and proposes the construction of a line, 250 miles long, from north line of Woodward County to southeast corner of Comanche County. Capital stock of company is $5,000,000 and headquarters at this place. The incorporators are: A. J. Robinson, Frederick, Okla.; J. M. Bellamy, Chas. G. Shane, S. R. Thornhill and F. P. Cease, of Lawton. J. M. Bellamy, who is primarily interested in the company, is now promoting a line from Lawton to Wichita Falls, Tex.

Portsmouth, O.—Surveys for the proposed road of North & South Ry. Co. have been completed from this place to Pound Gap, Ky. The line will be 180 miles long and it is planned to begin construction work in the spring. Edgar Parsons, Springfield, O., is Chief Engineer. Dr. L. E. Niles and Major T. J. Kirkpatrick, Springfield, O., are interested.

Astoria, Ore.—Oregon R. R. & Navigation Co., G. W. Boschke, Chief Engineer, Portland, Ore., is to expend $75,000 in this city in extending its wharf, erecting warehouses, etc.

Columbia, Tenn.—Louisville & Nashville R. R. is reported to have completed surveys for a cut-off line between Larks Mill, north of Columbia, and Glendale, south of this place. The line, if built, would be used for through freight and passenger service. J. E. Willoughby, Louisville, Ky., is Engineer of Construction, L. & N. R. R.

Cheyenne, Wyo.—The Wyoming Short Line Ry. Co. has filed its articles of incorporation and proposes to construct a railway from Wiley in the Big Horn Basin to the eastern line of Yellowstone Park. The capital stock is $2,500,000, and the road as projected would be 50 miles long. The Big Horn Development Co., which is reclaiming 300,000 acres of land in the vicinity of Wiley, and which is supported by Chicago capital, is back of the project.

Electric Railways.

Items Arranged Alphabetically by States.

Dothan, Ala.—Necessary $50,000 bonus and right of way is said to have been secured for building an electric railway between this place and Geneva. The project is backed by Richard Tillis, Montgomery, Ala.

Long Beach, Cal.—Frank A. Crowe, Long Beach, has been granted franchises to build street car lines in 7th St. and in Pine St.

Oakland, Cal.—Oakland Traction Co. has been granted franchise to operate a line of street cars along Grand Ave., Union and Macadam Sts., and Buckeye Ave.

Pasadena, Cal.—It is believed here that the Pacific Electric Ry. Co. will shortly take steps to construct an electric railway from the center of Pasadena, through the northwest section, and either to La Canada or direct to Millard's Canyon.

Redlands, Cal.—Local Board of Trade has taken up proposition of W. F. Whittier, of San Francisco, Cal., for the construction of an electric railway from San Jacinto Valley to Redlands. Mr. Whittier proposed to build a line to cost about $600,000, bonds for half of which he would take, and the remainder would be taken by Redlands, Hemet and San Jacinto.

Colorado Springs, Colo.—Manitou Incline Ry. Co., capitalized at $200,000, has been incorporated. The company has purchased from the Hydro Electric Co., the cable tram road running from Manitou to the summit of Mount Manitou, one mile distant, and will rebuild line, and put on new equipment. In addition it is said that the company is considering plans to build a road to the summit of Pike's Peak. The principal offices of the company are in this city, and W. N. Brumbach, Denver, Colo., is President, and Chas. L. McKesson, Colorado Springs, is Superintendent.

Dover, Del.—Formation of a stock company to operate an electric railway in Kent and Sussex Counties is being advocated by Walter Morris, of Dover.

Wilmington, Del.—A right of way through New Castle County has been practically secured for the projected electric railway of the Smyrna, Kent County & Delaware Bay Traction Co., and it is probable that construction work may be started soon. J. W. Endean is interested.

Marietta, Ga.—Preliminary surveys are to be started at once for a new electric railway to connect this place with Atlanta by way of McLand, Powder Springs, Austell and Mabelton. Charter is to be applied for shortly for the company which will be known as the Marietta-McLand Ry. Co., and will have capital stock of $500,000. John McEachern, Atlanta, Ga., and W. J. Manning, Marietta, are interested.

Marshalltown, Ia.—Surveys are reported under way for the interurban railway to be built from this place to Melbourne. Hamilton Browne, Chicago, Ill., is promoter of the projected road.

Richmond, Ind.—Advices from this city state that a New York bonding company has agreed to finance the projected Richmond and Hamilton traction line, of which Lewellyn Bond, Oxford, O., is Engineer. As planned the road will touch both Oxford and College Corner, and will have a spur to Liberty, Ind.

Minneapolis, Minn.—Minneapolis, St. Paul & Suburban Traction Co. is reported to be planning to build an extension of system from Excelsior to Manitou, with the object of reaching Tonka Bay from the latter place over the tracks of the M. & St. L. R. R.

Oregon, Mo.—Oregon Interurban Ry. Co. has been incorporated with capital stock of $60,000 and proposes to build a standard-gage road from Oregon to Forest City, a distance of six miles. All the incorporators are citizens of Holt County, among them being Benjamin F. Morgan, Lewis I. Moore, Charles D. Zook, William Derr, Henry C. Cook, Wm. H. Richards and Daniel Zachmann.

Babylon (L. I.), N. Y.—Village Trustees have granted franchise to South Shore Traction Co. for a trolley line on Cooper and James Sts., and Deer Park Ave. The South Shore Co. is to build and operate a line from Brookhaven west to Blackwell's Island Bridge, Brooklyn.

Larchmont, N. Y.—New York & Stamford Ry. Co. has been granted permission to double track its lines in Larchmont Rye and Portchester. New York & Stamford Ry. Co. operates an electric railway from New Rochelle, N. Y., to the Connecticut State line, where it connects with an electric railway extending to Stamford, Conn. The double tracking in the above towns is said to be the first step toward double tracking entire system.

Troy, N. Y.—Preliminary application has been filed with State Public Service Board for the construction of an electric railway from Brainard to point on Albany & Hudson R. R., in East Schodack. This is understood to be the first link of the proposed Troy, Rensselaer & Pittsfield R. R. The Albany & Hudson line, it is understood, will be used from Brainard into Albany and at the other end the Pittsfield Street Railway will be used to enter Pittsfield. That line is already being extended westward. The proposed line will be about 35 miles long and will open up a new territory.

Zanesville, O.—The Central Valley Electric Railway, Light & Power Co. purchased from H. D. Blodgett, promoter and contractor of this city, the rights of way for an interurban from Duncan Falls to Beverly, the company already having rights of way from Zanesville to Duncan Falls. The ultimate project is an interurban line from this city to Parkersburg. J. F. Townsend, Canal Dover, O., is interested.

Oklahoma City, Okla.—Oklahoma Interurban Traction Co. of Oklahoma City, with $500,000 capital stock, has been chartered and proposes to build an electric interurban in Oklahoma City and Capitol Hill and to El Reno. The incorporators are: L. E. Patterson, S. C. Glasgow, G. F. Benz, John H. Wright and Lee Hamilton.

Johnstown, Pa.—Surveys are to be started shortly, it is stated, for the trolley extension of the Johnstown Passenger Railway Co. from Walnut Grove to Gelstown.

Wilkesbarre, Pa.—Wilkesbarre & West Side Railway Co., has been granted permission to build a branch to electric railway beginning at Main St. and Courtdale Ave., in Luzerne Borough and continuing through Courtdale.

Hanford, Wash.—Hanford Irrigation Co. has completed surveys for a trolley line from Hanford to North Yakima to a point where the road will connect with the Milwaukee Railway further west.

Reedsburg, Wis.—Citizens of this place are considering plans for building electric railway from Reedsburg to Kilbourn by way of Mirror Lake. Mayor S. A. Collins is interested.

Brantford, Ont.—By the terms of a new franchise the local street railway company must lay between six or seven miles of new lines within two years.

Cobalt, Ont.—Work is to be commenced shortly, it is said, on the construction of a new electric railway in the Cobalt District of Ontario. The road will extend along Lake Temiskaming and will connect Cobalt and New Liskard, Ont., 14 miles distant. Among those interested are Judge Carlos M. Stone, Cleveland, O., and M. J. O'Brien, Ottawa, Ont.

Electric and Gas Plants.

Items Arranged Alphabetically by States.

Hot Springs, Ark.—New electric light plant is to be established here by Atwood Benton, Kansas City, Mo.

Chico, Cal.—L. D. Macy has been granted franchise to construct and operate an electric light, heat and power system in this city.

Santa Rosa, Cal.—Snow Mountain Water & Power Co., which is developing power from Eel River, has been granted additional franchises for transmission lines covering entire county.

Ventura, Cal.—Ventura Gas & Electric Co., capitalized at $250,000, has been incorporated.

Vincennes, Ind.—The Black Hawk Light, Heat & Power Co., of Vincennes, recently incorporated with a capital of $1,000,000, will soon let contracts for the laying of natural and artificial gas mains, for the construction and equipment of gas and light plants in the several towns and cities in southwestern Indiana. W. C. Reger, Henry Tapping and H. C. Bauer are interested.

Williamsport, Ind.—Williamsport Electric Light Co., according to reports, will at once rebuild plant.

Ardmore, Ind.—The Arbuckle Falls Light & Power Co., of this city, has been incorporated with a capital stock of $100,000. Morris Saas, L. P. Adkins, F. B. McIlroy are interested.

Lecompte, La.—Village contemplates installing municipal electric light system.

Fowlerville, Mich.—Fowlerville Lighting Co., capitalized at $15,000, has been incorporated.

New Bremen, O.—City has voted to issue $25,000 of bonds for installing municipal lighting plant.

Zenia, O.—Trustees of the Ohio Soldiers' and Sailors' Orphans' Home at Zenia in their annual report, ask for a special legislative appropriation of $100,000 to install complete new power plant and sewer system.

Clinton, Okla.—The City Council has granted an electric light and power franchise to F. Murch, of Hennessey, Okla.

Roseburg, Ore.—The Southern Pacific R. R. contemplates installing its own electric light plant here.

Sewers.

Items Arranged Alphabetically by States

Redondo, Cal.—City is to ask bids at once for constructing sewer system and septic tanks, to cost about $40,000.

Sacramento, Cal.—Special election was held Nov. 19 to vote on issuing $200,000 bonds for constructing sewer system to drain eastern and southern portions of city. System is to consist of a reinforced concrete trunk line sewer and laterals, flush tanks and pumping units.

Elgin, Ill.—Plans have been been completed by City Engineer Plum for proposed sewer system for the 6th ward.

Herrin, Ill.—Construction of sewer system here is advocated.

La Harpe, Ill.—Matter of installing surface drainage system for this place is under consideration.

Rock Island, Ill.—City is securing right of way for its projected $106,000 sewer construction of which is to be started in the spring.

Shelbyville, Ky.—City has voted to issue $30,000 of bonds for building sewer system.

Fenton, Mich.—Plans and estimates are being made for sewer system for this city. Riggs & Sherman, Toledo, O., are the engineers.

St. Paul, Minn.—City Engineer has submitted preliminary estimates of cost of new sewer in Prior Ave. to Board Public Works. Sewer would cost about $30,500.

Kansas City, Mo.—Board Public Works in accordance with request of Mayor H. M. Beardsley is getting data for improving city sewer system, and will probably secure expert engineer to determine what sort of system is best adapted to the city.

Carlisle, Pa.—City will vote on issuing $150,000 of bonds for constructing sewer system.

New Cumberland, Pa.—This borough is considering construction of a new sewer system to cost about $30,000.

Jeannette, Pa.—Borough Council will shortly ask bids for constructing sewer.

Marcus Hook, Pa.—State Health Department has suggested that this borough have plans made for comprehensive system of sanitary sewers.

Easton, Pa.—Election will be held Feb. 18 to vote on $241 loan for sewer system, disposal plant, etc.

Glenshaw, Pa.—State Health Department has granted Glenshaw Village, Shaler Township, a permit to build sewers.

New Cumberland, Pa.—Public meeting will be held to arrange for a $30,000 sewer system.

Knoxville, Tenn.—Bids are to be asked next month for the extensioin of the First Creek sewer in the 11th ward. Improvement will cost about $14,000.

Cameron, Tex.—N. Werenskiold, C. E., Dallas, Tex., is preparing plans and specifications for a sewer system for this place.

Prairie View, Tex.—New sewer system to cost $5,000 is to be installed at the State Normal school in this city.

Montreal, Canada.—Council Finance Committee has voted $40,000 for building sewer in Villeray.

Water Supply.

Items Arranged Alphabetically by States.

Headland, Ala.—Election is to be held to vote on issuing bonds for constructing water works and electric light plant.

Vallejo, Cal.—City may expend $70,000 in enlarging its storage water supply system.

Vallejo, Cal.—Plans are under consideration for improving city water supply.

Palmetto, Fla.—A $10,000 bond issue has been voted by this place for water works.

Dallas, Ga.—City has voted to issue $30,000 bond issue for installing water works.

Sparks, Ga.—City has voted to issue $20,000 of bonds for water works and electric light plant.

Spirit Lake, Ia.—A $20,000 bond issue has been voted for water works.

East Moline, Ill.—City is to expend $9,000 for water works improvements.

Jeffersonville, Ind.—Trustees of State Reformatory will ask legislature for an appropriation for installing independent water system for the reformatory.

Evansville, Ind.—City Council has decided to install mechanical filtration plant.

Wichita, Kan.—Hiram Phillips, Consulting Engineer, 615 Frisco Bldg., St. Louis, Mo., has been employed by this city to draw plans for a new system of water works, and also to make estimate of the present worth of the Wichita Water Co.'s plant.

McPherson, Kan.—Committee of which Mayor L. C. Criner is a member, has been appointed to arrange, if possible, for purchase by city of plant of McPherson Water & Light Co. Council has ordered water company to extend its mains on several streets.

Caro, Mich.—Several water main extensions will be made. H. R. Howell is Village Clerk.

Fowlerville, Mich.—Water works are to be installed here.

Lansing, Mich.—Extensive additions to city water works will have to be made soon, according to reports.

Saginaw, Mich.—Board of Estimates is considering issuing $56,000 of water main extension bonds.

Harrisonville, Mo.—This place has voted to issue $30,000 of bonds for constructing water works.

Worthington, O.—Plans have been prepared for water works for this place.

Cambridge, O.—City has voted to issue $50,000 of bonds for water works.

Massillon, O.—A $295,000 bond issue for water works has been authorized.

Zelienople, Pa.—A $10,000 bond issue has been voted for water works.

Mountville, Pa.—Water works are to be built here by Horatio Sands, Pottstown, Pa.

Reading, Pa.—Surveys are being made for new filter plant and mains. Elmer H. Beard is City Engineer.

Estelline, S. Dak.—City Council will probably take steps for construction of municipal water works.

Estelline, S. Dak.—City has voted to construct water works.

Newport, Tenn.—A $50,000 bond issue will be sold Jan. 2, proceeds of which will be used for constructing water works, sewers and light plant.

Denison, Tex.—Pumping station of Denison Water Co. will be remodeled at a cost of $30,000, it is said.

Teague, Tex.—Installation of water works is being advocated.

Temple, Tex.—City proposes to purchase local water works.

Ephraim, Utah.—Movement has been started to establish water works here.

Norfolk, Va.—A $50,000 bond issue for purchase of water meters has been authorized.

Lynden, Wash.—An $18,000 bond issue for water works will be voted on at coming election.

Oshkosh, Wis.—Oshkosh Water Works Co. has been istructed to extend its mains.

Appleton, Wis.—Special election will be held Dec. 17 to vote on purchase of old water works.

Manitowoc, Wis.—Manitowoc Water Works Co. is considering making improvements to its plant at a cost of about $30,000. New boiler would be installed and additional well sunk.

Cheyenne, Wyo.—City has voted to issue $150,000 of bonds for extending and enlarging water mains.

Sheridan, Wyo.—This city has voted to issue water works and sewer bonds.

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CAST IRON WATER PIPE.

Department of Public Works.
Chicago, Ill., November 23, 1907.

Sealed proposals will be received by the City of Chicago until 11 a. m., Saturday, December 7, 1907, at room 224 City Hall, for furnishing and delivering to the City of Chicago at the city pipe yards, approximately fifty-three hundred (5300) tons of cast iron water pipe, from 6 inches to 12 inches in diameter, according to plans and specifications on file in the office of the Department of Public Works of said city, room 317 City Hall.

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Companies or firms bidding will give the individual names as well as the name of the firm with their address.

JOHN J. HANBERG.
Commissioner of Public Works.
By PAUL REDIESKE.
22-2t Deputy Commissioner.

U. S. ENGINEER OFFICE, Portland, Oreg., Nov. 23, 1907. Sealed proposals for construction of one wooden hull hydraulic dredge will be received here until 11 a. m., Dec. 23, 1907, and then publicly upened. Information furnished on application. S. W. Roessler, Lt. Col., Engrs. 22-3t

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U. S. ENGINEER OFFICE, Portland, Oreg., Nov. 20, 1907. Sealed proposals for construction of one stern wheel steamboat will be received here until 11 A. M., Dec. 20, 1907, and then publicly opened. Information furnished on application. S. W. Roessler, Lt. Col., Engrs. 21-4t

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SEALED PROPOSALS will be received at the office of the Light-House Engineer, Tompkinsville, New York, until 1 o'clock p. m., Dec. 16, 1907, and then opened, for furnishing two fourth order lanterns for Honolulu Range Light-Stations, Hawaii, in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to the Light-House Engineer, Tompkinsville, N. Y. 21-3t

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19-3t FRANK A. SPENCER, Secretary.

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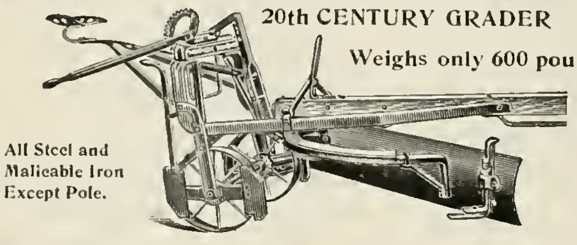

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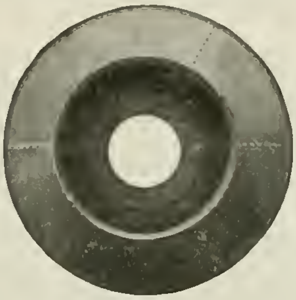

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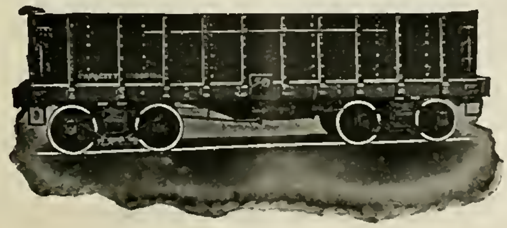

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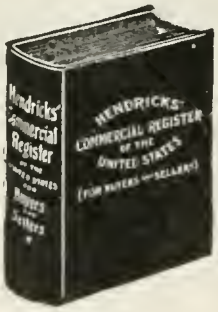
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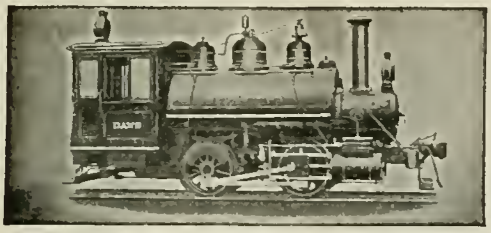

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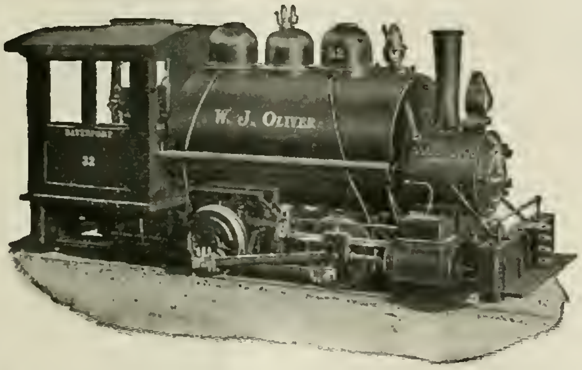

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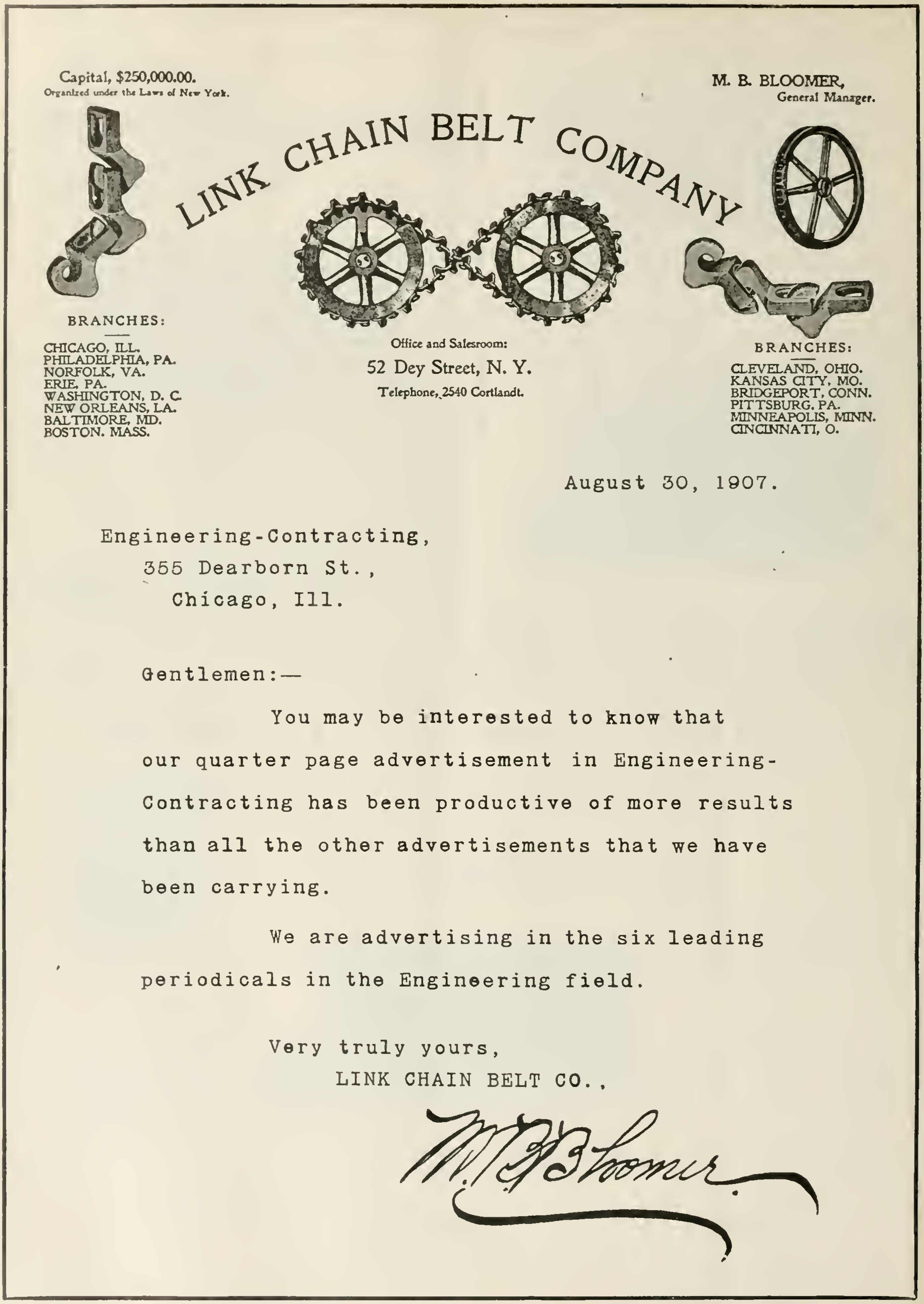

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Perpetuating the Panama Blunder.

What is it in the climate of Panama that addles the common sense of every chief engineer who has gone there? Two railroad engineers and an army engineer have perpetuated the early economic blunder of attempting to do this vast work by day labor instead of by contract. Yet each of these three chief engineers went to Panama as a believer in the contract method of doing work, because his whole life's experience had taught him how inefficient men are when working by the day for a railway company or for a government. It begins to look as if the desire to be known as the great and only builder of the Panama Canal so works upon the mind of every chief engineer of this enterprise that he no sooner takes charge than he begins to frame reasons why it is inadvisable to call in contractors to assist him. At any rate we now have the annual report of the Isthmian Canal Commission, teeming with arguments in favor of continuing the day labor system. We quote:

"Omitting profits derived from subsistence and general stores, and assuming the hours of labor the same in both cases, it stands to reason that the Government, when warranted in making the necessary outlay for plant, can do work cheaper than a contractor, for no question of profits enters into the consideration."

It does *not* stand to reason that any government can do work as cheaply as a private party. Indeed, to make such a claim is going contrary both to reason and to experience upon which all reasoning is founded. The Isthmian Commission goes on to explain that on jobs of less magnitude than the Panama Canal it does pay to do the work by contract, because, in such cases, the Government has neither the plant nor the organization to do the work. In the case of Panama, however, the Government has both. The grave fallacy in this argument lies in the assumption that it is economic to award contracts only because a suitable plant and an organized force of men can be secured quickly. These, it is true, are factors in favor of a contractor, but if they were the only factors, government contracting would have disappeared entirely fifty years ago. The Government could well afford to own a sufficient plant to do all its construction work, and it would not take long to build up an organization to handle the plant. But plant and organization are merely the tools. Back of these tools must be a great incentive if work is to be done economically with this plant and this organization. Plant is nothing, organization is nothing, unless the brain that directs both is keenly bent upon saving every penny and entirely free to bring every resource to bear in effecting economy. It is this lack of sufficient incentive and of sufficient freedom of action that makes every government manager of work far inferior to the ordinary contractor. A government employee knows that his salary will go on regardless of the cost. Earth work may be costing the Government 50 cts. a yd. that would cost a contractor 30 cts., but Col. Goethals will draw his $25,000 a year just the same, and so will every other employee clear down to the water boy. It is true that the Chief Engineer is actuated by the vague desire to make a "good record," but he is also well aware that his "record" can not be measured by any standard except the accomplishment of his two predecessors. The great desire to make wealth for himself is wholly absent. His brain is warmed to mild glow by the hope of being able to "make good," but there is no fire under his boiler that sets the steam valve popping. But granting him even a considerable amount of feverish desire to "make good," we find him bound hand and foot, not by red tape but by the indifference of the vast majority of his employees. Why should his lieutenants sit up nights devising ways of reducing costs? Why should they go about jumping on the workers by day to sting them into action? The one act may break down health, they will tell you, and the other will surely make enemies of the men. What recompense will there be for these two losses? A share in the saving effected? No. A partnership in the business? No. An increase in salary? No, for governments do not pay on the scale of what a man saves but upon the scale of what he spends. There are no bonuses, no special salaries for excellence in service, no partnerships—nothing but a mild hope that if one does not die at the bottom promotion to a higher rank will come some day as a result of death at the top. That is government work, and that is why a contractor's profit represents not additional cost to the government but merely a small fraction of the saving effected by a capable man driven by the fierce desire to make that saving as large as possible.

To illustrate what happens even to a contractor when this incentive is removed: On the Chicago Main Drainage Channel the firm of MacArthur Bros. was put in charge of excavating a section of glacial drift on a percentage basis. They furnished the plant and organization, but did not pay for the labor or supplies out of their own pockets. That was paid for by the Sanitary District and MacArthur Bros. received 15% for use of plant and supervision. After a considerable amount of the earth had been excavated at a cost of 86½ cts. per cu. yd., the Sanitary District gave up this day labor method in disgust. In a report on the work Chief Engineer Isham Randolph said: "This work may be regarded as an object lesson, clearly demonstrating from an economic standpoint the unwisdom of entering into any arrangement for carrying on the construction work of the Sanitary District by the direct employment of labor." (Hill's "Chicago Main Drainage Channel," page 33.)

We cite this case because the MacArthur Bros. are among the most competent contractors in the country, but even they could not combat the irrisistible tendency of men to loaf the minute they know that a government is going to foot the bill, and not a contractor.

Plant expense should be only a minor part of the cost of excavation at Panama, and it is the worst kind of sophistry to at-

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tempt to make the country believe that this element is a factor in deciding whether or not the work should be done by contract. The great item of expense is labor. It overshadows everything else. It is equally fallacious to use the magnitude of the work as an argument against letting it by contract. The excavation can be divided into sections, and handled under separate contracts. It is a part of the same sophistry to argue that laborers could not be secured by contractors, because foreign governments would then oppose emigration to Panama. If the Uinted States will merely continue to keep the Isthmus in a sanitary condition, no reason will remain for any opposition to emigration.

Looked at from any angle of view, this last report of the Isthmian Canal Commission is just a document of praise for the worse economic blunder the United States has ever committed. With proper methods of awarding contracts, there is not the slightest doubt in our minds that the cost of excavation can be reduced fully one-third below the present cost. During the last fiscal year, 5,570,000 cu. yds. were excavated in the Culebra Division, of which more than 40% was earth. The unit cost was 82½ cts. per cu. yd., including an allowance of 12 cts. per cu. yd. for first cost of plant distributed over the total yardage to be moved. The expense of dumping alone was 15½ cts. per cu. yd.! While skilled laborers receive high wages, unskilled laborers are hired for less than $1 (gold) per day.

In a subsequent issue we shall present an analysis of the cost which will throw an even more startling light on the subject than is obtainable from general figures.

Why Actual Cost Records Are of Little Value Unless Analyzed Into Component Elements.

Many engineers will concede that contract prices are of small value as a guide in making estimates, but the same engineers often contend that it is futile to attempt to estimate unit costs by any synthetic process. They claim that it is safer to "size up" the situation, and then, drawing from their fund of experience, make a shrewd guess at the probable cost. We purpose showing how devoid of logic this method of "estimating" costs really is.

Let us take, for illustration, the cost of a reservoir embankment. The cost may be divided into six component elements: (1) loading, (2) transporting, (3) spreading, (4) removing large stones, (5) sprinkling, and (6) rolling. But let us assume that an engineer has kept a force account in such a way as to show only the aggregate unit cost. In using this unit cost as a basis for making estimates of the cost of similar projected work, the engineer is always forced to add or subtract, for conditions are never identical. A change in conditions will increase or decrease the unit cost. How much? Suppose the projected embankment work is identical in every respect with the finished work, whose unit cost the engineer already knows, except in one item and that is the distance of transportation. Unless the engineer has kept his records in such shape as to be able to segregate the cost of transportation per unit of distance, he is absolutely helpless when called upon to modify his gross unit record of the cost of one embankment so as to secure a reliable estimate of the cost of the other embankment that involves a different distance of transportation.

If the projected embankment work is identical with the finished work in all respects but one, and that one is the percentage of stones that must be removed before rolling, the engineer is again forced to guess, unless he has kept detailed records showing the cost of removing a given percentage of stones from each yard of embankment.

If the two embankments are identical in all respects save one, and that one is the toughness of the earth, the engineer is again forced to guess, unless he has kept records of the cost of loosening and loading material in soils of different degrees of toughness.

By this same method of reasoning it becomes clear that *no logical method of estimating costs is possible unless records have been kept of each of the component elements of cost.* It is true that many engineers attempt to make estimates by reasoning "in the lump," so to speak, but such reasoning has not even the justification of a woman's intuition, and is completely unworthy of attempted justification on the part of any man, least of all an engineer. No engineer would guess at the weight of steel in a projected bridge of span differing from any previously built. Yet the same engineer who would enter into a most careful analysis of the proper sizes for each member of a bridge, and thus derive the weights of the component elements, will often pooh-pooh the idea of analyzing the costs of construction labor and supplies. To suggest such a procedure to him is a heresy. He shakes his forefinger in your face and says: "For twenty years I have been making estimates of cost, and I have never had occasion to resort to an analysis of costs. I regard a man who uses that method as utterly unworthy of confidence, because he is striving to reduce to a science that which can never be more than an art, and a very erratic art at that."

You ask him how long it has been since hydraulics ceased to be an art, and "a very erratic art at best." He squints his brows with the effort of memory and tells you that, no doubt, engineers knew little about hydraulics eighty years ago; and, you add, "They knew less about bridge design." But, he hastens to say: "That is all very different from cost estimating, which never can be reduced to a science."

Doubtless had you talked with this man's grandfather you would have been informed with equal positiveness that no science of strains and stresses could ever be developed, due to the multiplicity of conditions and erratic behavior of materials.

The truth is that cost estimating can be done with far greater accuracy to-day than is attained in designing a bridge. For, when the best designer of bridges has finished his calculations he uses a factor of safety of 2 to 5, to make sure that his ignorance is protected by a margin of several hundred per cent. Cost estimating is a science, and it was not born yesterday, in the brains of some men, although it bids fair never to have birth in the brains of others who have probably passed the age limit of parentage of new ideas.

Cost analysis enables one engineer to apply data gathered by another engineer, just as an analysis of stresses in a bridge is correctly made by a young engineer who has never seen the building of any framed structure. It is true that no man can become the highest type of a cost analyses engineer without having some experience of his own to guide his application of the data gathered by other engineers, just as it is true that no engineer can ever become an expert bridge designer without a certain amount of experience in a bridge shop and in the field.

When men reasoned "in lumps" about bridge designing, they really did no reliable reasoning—they guessed. All was rule of thumb of the crudest sort. The same holds true of all engineers who still reason "in lumps" about costs. Their conclusions may or may not be correct, and can withstand no searching attempt to ascertain their correctness.

It is a great pity that so many engineers have kept and still keep their records of cost in the lump, for they thus lose the greater part of their experience as to costs. To illustrate: An engineer records the cost of rock excavation, and, at the end of the job, is able to tell you that its actual cost was $1 per cu. yd. He enters this record in his note book, and fancies that he has recorded a very valuable part of his experience, particularly if this $1 is the average of many thousands of yards. Five or ten years later he has occasion to refer to this record. Wages of common laborers have risen, but explosives have become cheaper, and, to save his life, he can not remember what the wages of rock drillers were then as compared with now. Even if he could accurately determine the per cent of change in each of these elements he could not apply it, for he has no record showing what part of the $1 was expended for these elements of cost. Probably he has neglected to record the distance of transportation, but is sure that it does not correspond with the distance in the projected work under consideration. In brief, his much prized record of $1 a yd. for rock excavation proves to be practically worthless until such a day as he shall again find a piece of projected rock excavation under precisely the same conditions as to hardness of rock, prices of supplies, wages of men, distance of haul, and methods and tools used.

When driven to the last extremity of defense, an engineer who reasons about costs "in the lump" will reply that nobody but the contractor can possibly know *all* the costs anyway. General expense and plant expense are often unobtainable by an engineer on any particular job, but it is a great mistake to assume that they can not be closely estimated, if the experience of other men on similar work is available. The cost of maintenance and repairs of steam shovels, for example, has been carefully kept both by mining companies and by railway companies, and is available. Then, if an investigation of many records establishes the fact that the cost of maintenance and repairs of a steam shovel rarely exceeds 2% of its first cost per month of actual operation, the engineer can not be far wrong in making that assumption. So, likewise, if a study of the cost of repairs and renewals of locomotives on the railways of America discloses an annual cost of about $2,400 per locomotive of a size whose first cost is $10,000, the engineer can safely allow 2% per month on the first cost of locomotives for repairs and renewals. In like manner, plant repairs and renewals can be estimated for different kinds of plant within narrow limits of probable error, *provided an engineer will take as much pains in studying the cost phase of an engineering problem as he takes in the designing phase.*

The crass ignorance of cost analysis that characterizes so many engineers to-day can be traced straight back to the colleges from which they come. Professors, who themselves often know nothing of costs, have taught young engineers to believe that costs are of no particular value unless gathered by their own personal efforts; and we are not only quite ready to concede that this holds true of unit costs kept in the lump, but we will go a step further in adding that even those lump costs are themselves almost valueless. These professors, having started young engineers on their career with entirely wrong conceptions as to costs, are, in the final analysis, the ones really to blame for the present scandalous ignorance of the very elements of cost analysis so prevalent in the profession of civil engineering to-day. Fortunately there are some thousands of civil engineers who are now diligently training themselves in cost analysis, and there are many who have already attained great skill in this science.

In the supremely fine application of any science there is always a touch of art. So it will remain true of the science of cost analysis, as of bridge design, that, in using it, practice and natural skill will have a strong influence in securing the greatest measure of success.

Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Method and Cost of Molding Large Concrete Slabs for Girder Bridges.

In its work of track elevation at Chicago, Ill., the Chicago, Burlington & Quincy R. R., crosses intersecting streets on four-span girder bridges composed of heavy reinforced concrete slabs carried by two abutments and three lines of columns. The girder slabs were matched separately, allowed to harden and then shipped from molding yard to bridge site and placed in the supporting columns and abutments. The bridges have two 24¼ ft. spans over the roadway and a 10¾-ft. span over each sidewalk.

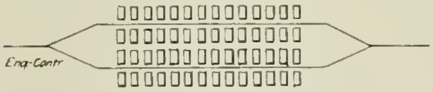

Fig. 1—Sketch Showing Arrangement of Slab Molding Yard.

The larger slabs were 24 ft. 3 ins. long, 33 ins. thick and 7 ft. wide; each contained 16¾ cu. yds. of concrete and weighed 36¾ tons. The smaller slabs were 10 ft. 9 ins. long, 17 ins. thick and 7 ft. wide; each contained 3.65 cu. yds. of concrete and weighed 7.8 tons. The weights given were found by actual weighing, they make the weight of the reinforced slab between 160 and 162 lbs. per cubic foot. The concrete was generally 1 part cement and 4 parts pit gravel below 2-in. size. The reinforcement consisted of corrugated bars. The method of molding was as follows:

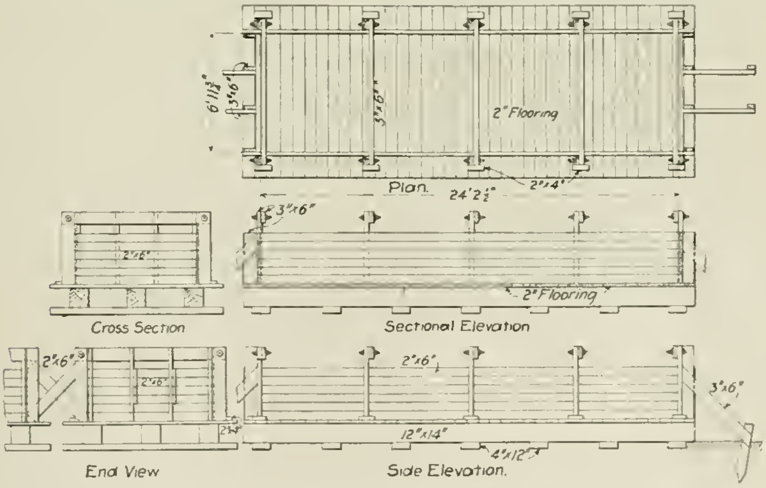

Fig. 2—Details of Form for Slabs for Girder Bridges, C., B. & Q. R. R.

One of the company's yards at Morton Park consisted of a cinder fill. This area was leveled off and tamped, then the forms were set up on both sides of two lines of railway track arranged as shown by the diagram, Fig. 1. The exact construction of a form for one of the larger slabs is shown by Fig. 2. The side and end pieces were so arranged as to be readily taken down and erected for repeated use. About 100 floors were used, and they had to be leveled up each time a slab was molded as the lifting of the hardened slab disarranged them. Particular care was taken in keeping the floors level. The side and end forms were covered in about a week or sometimes ten days, but the slab stood on the floors 90 days before removal, being wetted every day for two weeks after molding.

The plant for mixing and handling the concrete was one of the company's standard concrete mixing trains for retaining wall work. A flat car had a rotary drum mixer mounted on a platform at its forward end. Beneath the mixer was a hopper provided with a deflector which directed the concrete to right or left as desired. Under the hopper were the ends of two inclined chutes extending out sideways beyond the car—one to the right and one to the left—and over the slab molds on each side. Above the mixer was another platform containing a charging hopper, and from the rear of this platform an incline ran down to the rear end of the car and then down to the track rails. A car loaded with cement and gravel in the proper proportions was hauled up the incline by cable operated by the mixer engine, until it came over the topmost hopper into which it was dumped. This hopper directed the charge into the mixer below; the mixer discharged its batch into the hopper beneath from which it flowed right or left as desired into one of the chutes and thence into the mold. The chutes reached nearly the full length of the molds and discharged over the ends into the far end of the mold or through a trap over the end of the mold nearest the car.

To the rear of the mixer car came a cement car provided with a platform overhanging its forward end. Two hoppers were set in this platform each holding a charge for one batch. Coupled behind the cement cars came three or four gravel cars. These were gondola cars and plank runways were laid along their top outer edges making a continuous runway for wheelbarrows on each side from rear of train to front of cement car. The sand and gravel were wheeled to the two measuring hoppers and the cement was handed up from the car below and added, the charge was then discharged into the dump car below and the car was hauled up the incline to the mixer as already described. Two measuring hoppers were used so that one was being filled while the other was emptied, thus making the work continuous.

The molding gang consisted of 33 laborers, two foremen and one engine man. This gang averaged 7 of the large slabs per 10-hour day and at times made as many as 9 slabs. When molding small slabs an average of 12 were made per day. This record includes all delays, moving train, switching gravel cars on and off, building runways, etc. The distribution of the men was about as follows:

	No. Men.
Handling Materials:	
Shoveling gravel into wheelbarrows.....	9
Wheeling gravel to measuring hoppers..	9
Emptying cement into measuring hoppers	2
Handling cement to men emptying......	1
In charge of loading dump car.........	1
On top of cement car.....................	1
Sub-foreman in charge..................	1
Mixing and Placing:	
Engineer	1
In charge of mixer.........................	1
Hoeing and spreading in mold...........	2
Spading in mold	2
Finishing sides of block..................	2
General laborers	3
Foreman in charge.........................	1
Total men	36

This gang mixed and placed concrete for 7 blocks or 117¼ cu. yds. of concrete per day. Assuming an average wage of $2 per day the cost of labor mixing and placing was 61.4 cts. per cu. yd. or $10.28 per slab. It is stated that the slabs cost $11.80 per cu. yd. on storage pile. This includes labor and materials (concrete and steel); molds; loading into cars with locomotive crane, hauling cars to storage yard and unloading with crane into storage piles, and inspection, incidentals, etc. To load the slabs into cars from storage piles, transport them to the work and place them in position is stated to have cost $2 per cu. yd. The slabs were placed by means of a locomotive crane being swung from the flat cars directly into place.

The work as described is in charge of Mr. C. H. Cartlidge, Bridge Engineer, and Mr. L. J. Hotchkiss, Assistant Bridge Engineer, Chicago, Burlington & Quincy R. R., Chicago, Ill.

Cost of Molding and Method of Testing Small Cement Pipes.[*]

Construction and Cost.—The pipe discussed here was 6 to 12 ins. inside, made of Portland cement and clean, sharp sand of all sizes up to very coarse. The mortar was mixed rather dry, but very thoroughly, using 14.1 cu. ft. of sand to 1 bbl. of cement, or very closely a 1 to 4 mixture. From six to seven buckets of water were used to each barrel of cement, except for the 6-in. pipe, for which the mortar had to be made somewhat stiffer in order to remove the inner form, which is not made collapsible as in the larger sizes.

The forms were sheet iron cylinders with a longitudinal lap joint that could be expanded after molding the pipe, and removed without injuring the soft mortar. The inner form was self-centering, so that there was little variation in the thickness of the pipe.

Four men are required in making cement pipe by hand; one mixes the mortar, and wheels it to the place of work; another throws it into the form a little at a time with a hand scoop; a third rams it with a tamping iron, and a fourth keeps the new pipe sprinkled, and applies a coat of neat cement slurry to the inside when it is sufficiently hard. In molding, the form of the bell at the bottom is secured by an iron ring that is first dropped into the form, and the reverse or convex form at the top is made with a second ring. While still in its form the pipe is rolled or lifted into its place in the drying yard, and the form is then carefully removed. A very slight blow in removing the form will destroy the pipe, and a considerable number, especially of the larger sizes, collapse in this way, and have to be remolded. To avoid handling, the pipe is stacked on end a few feet from the place of mixing, the form being moved as the yard fills with pipe. One crew of four men can make about 250 joints or 500 lin. ft. of pipe a day.

As soon as hard enough, the pipe is turned end for end, and is then kept wet for several weeks before being laid. The coating of neat cement on the inside is applied with a short whitewash brush, and is a small item in the cost.

In laying, the trench is carefully finished to grade in order to have the joints close nicely, and the ends are well wet with a brush. The mason then spreads mortar, mixed 1 to 2, on the end of the pipe, and lays a bed of mortar at the bottom of the joint. He then jams the section into place, and swabs out the inside of the joint with a stiff brush, to insure a smooth passage for the water. A band or ring of mortar is spread round the outside of the joint as an additional reinforcement. One barrel of cement will joint about 300 sections of pipe. The materials cost as follows: Portland cement, per bbl., $4.45; labor, per day, $2; foremen, per day, $2.50 to $3; hauling, per load mile (1 cu. yd.), 20 cts.; sand, free at pit; water, free.

The pipe was all of a 1:4 sand and cement mortar, and the amount of cement in one foot of pipe is arrived at by assuming as in Gillette's "Hand Book of Cost Data" that where the sand has voids in excess of the cement used, the mortar will occupy 1.1 times the space of the dry sand, which yields the following formula: Where—

c = cost per bbl. of cement, or $4.45.

n = cu. ft. in one bbl. (taken at 3.5 here).

s = ratio of sand to cement, or 4.

d = inside diameter in inches.

t = thickness of pipe in inches.

l = length of pipe considered, or 1 ft. here.

Then:

$$\text{Cement-cost per foot} = \frac{c \times l \times \pi \times (dt + t^2)}{n \times s \times 1.1 \times 144},$$

$$\text{which gives here} = \frac{4.45 \times 1 \times 3.142 (dt + t^2)}{3.5 \times 4 \times 1.1 \times 144}$$

$$= 0.00631\ (dt + t^2).$$

This gives the following cement costs per lineal foot:

Diameter, ins.	Thickness, ins.	Cost per foot.
6	1¼	$0.0571
8	1¼	0.0730
10	1⅜	0.0998
12	1½	0.1278

The sand cost is based on 15 cts. per cubic yard for loading, and a haul of two miles of 1 cu. yd. to the load, making five trips per day, at $4 for man and team. It bears a constant ratio to cement cost, being 11.2 per cent of the cement cost. The labor cost of making is based on the foreman's estimate that a foreman, tamper, mortar mixer, and water man should finish 250 joints a day of 6 or 8 in. pipe. For the 10 and 12 in. pipe, the labor is assumed to be greater in proportion to the material. The foreman is taken at $3, one man at $2.50 and two at $2. The cement for painting the inside is neglected. Hauling the pipe to place is taken at twice the cost of hauling the sand per mile, and a haul of 4 miles is assumed. The cost of laying is based on a foreman's estimate of 2 cts. per foot for trench, and that one man to lay, one man to plaster the joints, one helper and one man to backfill will lay 600 ft. per day of 6 or 8 in. pipe. The larger sizes are assumed to cost more in proportion to their material.

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[*] Abstracted from a paper by Mr. Albert Eugene Wright, in the California Journal of Technology for October, 1907.

These various costs give the following results for small size pipe as made and laid at Irrigon, Ore., for the Oregon Land & Water Co.:

	Cost per foot for			
	6-in. pipe.	8-in. pipe.	10-in. pipe.	12-in. pipe.
Cement	$0.057	$0.073	$0.099	$0.128
Sand	0.006	0.008	0.011	0.014
Labor	0.019	0.019	0.026	0.034
Hauling	0.024	0.032	0.044	0.056
Laying	0.024	0.024	0.032	0.042
Trench	0.020	0.020	0.020	0.020
Totals	$0.15	$0.18	$0.23	$0.29

The above costs show that the pipe in place costs about twice as much as pipe in the yard, even with cement at $4.45, and illustrates the danger of accepting cement manufacturers' estimates without examining local conditions, especially as to handling.

Tests for Leakage and Strength.—The following method of making tests of small cement pipe under field conditions, without the use of a pressure gauge or any elaborate apparatus, was used by the writer for static heads up to 45 ft. Tests were made on 6, 10 and 12 in. pipe. Four 2-ft. sections of each size were laid with only ordinary care, the ends being plugged with mortar. A ¾-in. iron pipe threaded for an ordinary hose coupling was set in each end, as shown in the accompanying sketch. In measuring the leakage due to sweating, one of the iron pipes was capped, and a section of hose attached to the other. The free end being elevated a known distance, water was poured in by hand just fast enough to keep the system full. To avoid a change in pressure during the test, a wide mouthed funnel was soldered to a hose connection as shown. The quantity of water introduced was measured in a standard gallon can, the time being taken with a stop watch.

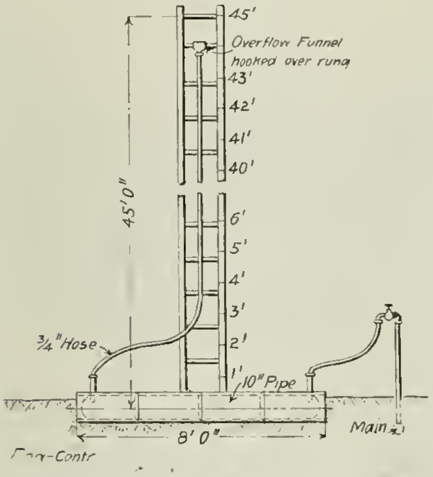
When heads as high as 10 ft. were passed the leakage was too great to handle with a small hand measure, and in addition the velocity of water down the hose become high enough to carry air with it, making the measurement of actual pressure on the cement pipe uncertain. Accordingly the cap was removed from the second outlet, and replaced by a hose attached directly to a hydrant. Water being turned on, any head up to 45 ft., the limit of the Irrigon water works, could be obtained by fixing the height of the first hose and running water through the system at a low velocity. It was found possible to regulate the tap so that the velocity in the standpipe was wholly negligible.

Leakage of course could not be measured while using the second method, but the pipe showed so much improvement after being filled for some time, and showed so small leakage in actual use that the loss of water through the sides of the pipe was neglected.

The pipe was kept wet both before and after laying for a total period of three months, before being tested. During this period, and after laying, several measurements were made of the leakage under a few inches pressure. After a few days' saturation the leakage was reduced about two-thirds, the tightening up being due to chemical action, since the water used was perfectly clear. It is believed in practice, where the water carried contains more or less sediment, that the loss due to sweating will be inappreciable.

Two of the nine joints between the pipe as laid leaked badly, and had to be patched before starting the tests, indicating that greater care than is ordinarily exercised in laying pipe must be taken where it is expected to stand any considerable head.

The 6-in. pipe began to sweat at a 10-ft. head. Pin holes showed when the head was increased to 25 ft. When under 35 ft. of pressure, the sand was dug away from the ends of the pipe, which was then pried over 1½ ins. or so without injury. The pipe showed no signs of failing at the highest head available, or 45 ft.



Device for Testing Small Cement Pipes.

The 10-in. pipe showed a defect at a head of 5 ft., due to a small stick in line with an annular tamping seam. At 10 ft. a distinct annular crack could be seen, and at 15 ft. the crack extended half way round the pipe, a line of pin holes showing its course. At a head of 27 ft. the pipe failed, not at the tamping crack, but in one of the joints.

The 12-in. pipe began to sweat at once round one of the joints, and at a head of 10 ft. showed a line of pin holes round the joint, connected by a fine hair crack. At 20 ft. head, the crack was visible for 12 ins., remaining the same at 25 ft. The joint failed at 35 ft. pressure.

It should be noticed that the logitudinal stress that broke the 10 and 12 in. pipe at the joints is not developed in practice, as the ends of pipe lines are run into substantial concrete "stands" in such a way that no end pressure is taken by the pipe. In fact, in practice the pipe has been frequently broken by water hammer, and has failed in a longitudinal crack down the top for several yards, irrespective of joints.

The tests cover too little ground to form the basis of general conclusions, but they do show the necessity of careful laying, and the danger of foreign matter such as straw or sticks starting tamping seams. They show that small pipe can be made to withstand heads up to 45 ft., the smaller sizes having the advantage. Leakage is a serious problem only at the joints, and it is possible to lay joints without leaks.

Method of Constructing Concrete Lock Walls by Means of Traveling Forms.

In placing several thousand cubic yards of concrete in the walls and floor of the lock that will secure navigation past the new Charles River Basin dam at Boston the contractors, the Holbrook, Cabot & Rollins corporation of Boston, Mass., made use of a novelty in the shape of a traveling form. The plant used is shown by the accompanying view.

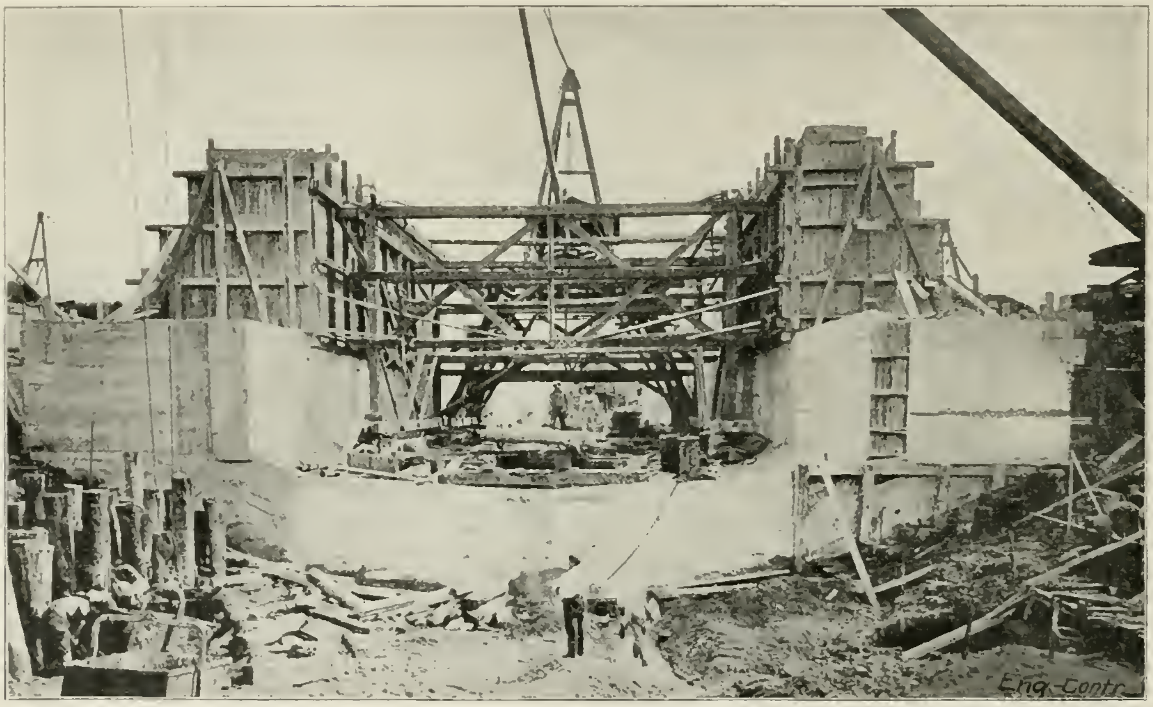
The lock was 492x45 ft. inside the walls. Gravel was raised by a rehandler operating an orange peel bucket to an elevated hopper 16x14 ft., with its top about 70 ft. above the bottom of the lock. From this hopper the material passed over four screens set at an angle of 1 to 12, which separated the material into the sand and stones, which were deposited in storage bins of 120 and 200 cu. yds. capacity. Below the storage bins were the measuring hoppers for getting the proper quantity of sand and gravel. After leaving the measuring hoppers, the sand and gravel passed to a 24-in. belt conveyor about 90 ft. long, which carried the mixture, together with the proper amount of cement, to a hopper directly over a cubical mixer holding a little over 2 cu. yds. From the cubical mixer the concrete was dumped into boxes holding about 2 cu. yds., mounted on trucks running on a track and operated by an endless cable. The boxes were of the bottom-dumping type, the doors automatically locking when replaced empty upon the car tracks.

The concrete boxes were handled by a movable bull-wheel derrick mounted on a platform at the elevation of the top of the lock walls, and carried on wheels running on rails laid on heavy timbers on each side of the bottom of the lock. The forms for the side walls of the lock were 40 ft. long and about 30 ft. high, and were built of 3-in. plank planed one side to even thicknesses. These side wall forms were hung from a traveler 30 ft. high and 40 ft. long, running in advance of the movable derrick on the same rails, and were placed in position by means of jacks and other bracing, as the case required.

The specifications provided that the lock should be built in sections not exceeding 40 ft. in length, and the ends of the sections were to have an offset or projection

6 ins. in width, to form a water-stop. The ends of these sections were covered with two layers of tar paper applied with a hot mixture of coal-tar pitch, which was first spread over the surface of the concrete, then between the layers of tar paper, and finally over the entire surface of the tar paper joint.

The sequence of operations in concreting one section of the lock was as follows: The excavation was completed to the proper grade; the piles were cut off and the bottom set of twisted steel rods, ¾ in. in diameter and 11 ins. on centers, was placed in position; the concrete, mixed in the proportion of 1—3—6, was brought up in level layers about 1 ft. thick to within a foot of the top of the bottom of the lock, and the top set of 1⅛-in. diameter twisted steel rods, 8 ins. on centers, was placed 6 ins. below the finished surface, and the top 12 ins. of 1—2½—5 concrete brought to the finished surface. The forms for the slope at the foot of the side walls, rising 2 ft. vertically in 3½ ft. horizontal, were then set and the concrete brought up to the top of the slope. After this concrete was set, the high side wall forms, 40 ft. long by 30 ft. high, were set and braced in position, after which the side walls were brought up in horizontal layers, care being taken to keep the opposite sides at about the same elevation. It required some ten days to complete a 40-ft. section of side walls after the bottom section was put in, and some two days more to move the high forms ahead and set them in position for the next section.



Lock Through Charles River Dam. Traveling Form for Constructing Lock Walls.

The question of the proper mixture and thickness to use for the facing of the side walls of the lock required considerable attention, and a series of experiments was made to determine what proportions made the most impermeable concrete. From the results of the experiments, and from what information was obtained by correspondence and from published reports, it was decided to use a layer 6 ins. thick for the facing, composed of 1—1—2 concrete. This was changed to 1—3 mortar after the results of further experiments were made known. This facing was carried up with the other concrete for the side walls, the 6-in. space being maintained by means of a steel diaphragm 12 ins. high and about 10 ft. long, with spacers 6 ins. long at each end and one in the middle to keep a uniform distance from the forms. As soon as the facing was placed, the diaphragm was removed and the mortar and backing spaded together to make sure of a good bond, and strips of No. 16 gage, 3-in. mesh, expanded metal, 12 ins. wide, were placed horizontally in the soft concrete 1 ft. apart vertically above elevation 98 and 2 ft. apart below that elevation, in order to prevent the facing from separating from the main portion of the wall.

According to a report of the U. S. Consul at Milan the first year's (1906-7) operation of the Simplon tunnel did not meet expectations. During the year only 27,400 tons of goods entered and 29,400 tons left Italy over this line, while 430,000 passengers were carried through the tunnel. The authorities expect that at least 100,000 tons of goods will annually pass through the tunnel. The line earned $5,170 per mile; the estimate was $6,000 per mile. The company calculated that the line would have to produce $6,000 in order that the second tunnel could be built, construction of which has been postponed.

An apparatus for transferring vessels from one level to another on canals and other waters is in use by the Grand Junction Canal Co. at Foxton, Leicestershire, England. The apparatus consists of a system of wet docks wherein vessels to be transferred are water borne. The docks are mounted on wheeled carriages sufficient to support them horizontally and to run on inclined railways extending between the higher and lower water levels, such railways being transverse to the length of the docks which travel broadside on so as to admit of a short length of wheel base and a steep grade. The docks are provided with end gates which open and close for the ingress and egress of vessels by rising or falling in a vertical plane, suitable grooves being provided for the gates to work it, and means are provided for making a water-tight closure. The end of each dock when in position at the top of its inclined railway makes a practically water-tight joint with the standing work of the extremity of what may be termed the head bay or upper pond. The dock then forms a continuation of the upper canal, there being also a similar gate provided at the end of each of the upper bays to retain the water in the upper level of the canal when the docks are absent.

At Nice, France, the Sewer Department has a specially trained fox terrier which they use in cleaning the sewers. The dog is fitted with a harness and trots through the sewer pulling a cord after him. To this cord is attached a large brush and when the dog emerges at the other end, the workmen pull the brush through.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

The Method and Cost of Surveying and Reclaiming Wet Farm Land.

The following paper was read by Mr. L. G. Hicks[*] before the Illinois Society of Engineers and Surveyors, in January, 1907. Mr. Hicks has furnished us with additional data, thus giving an added interest to his already valuable paper. Every year greater attention is being given to the draining of agricultural land, and the illustration here presented will give both methods and cost of doing this work.

"This drainage system is located on the estate of Mr. Guy C. Barton, at Gilmore, Sarpy county, Neb. Gilmore is on the main line of the Union Pacific Railway, and is eight miles south of Omaha. This estate, called 'The Walnuts,' is Mr. Barton's summer residence, and is farmed in the most modern manner under the management of Mr. George Warren Davis. There are 600 acres, more or less, in the estate, and this drainage system is located to the south of the Union Pacific Railway tracks and is on 'bottom land,' lying in the valley of the Papillion river. The soil in this tract drained is a very rich black loam, the washings from the surrounding hills lying to the north and south.

"This field is subject at various times of the year to overflows from Mud creek, a tributary to the Papillion river, and owing to the contour of the ground, a quantity of these flood waters were always left standing on the field after each rise of the creek. This excess of water on this very rich soil caused it to 'sour,' and during the summer months it was impossible to drive a team across the field on account of the soft nature of the ground. Crop after crop of corn was planted and each would get a good start, but would be destroyed later by the excess flood water that would stand on the ground after each flood. At last the field was given over to pasture, but it was found that the ordinary pasture grasses would not live on this wet sour soil, and for the past eight or nine years the only crops have been yellow dock weeds and crawfish. I have found in eastern Nebraska that one of the surest signs of needed drainage is the growth in a field of these yellow dock weeds and the presence of crawfish in the soil.

"In the early part of 1905, surveys were made and plans prepared for drainage systems for two of the low tracts of land in the estate, and this paper is a short description of the manner in which these drainage surveys were made and one of the systems installed.

"Topographical Maps.—The boundary lines of each field were accurately run out, and along each side, at intervals of 100 ft., were placed 3-ft. laths with a small cheese cloth pennant attached, alternating red and yellow. Station No. 1 on north and south sides being yellow, and station No. 2 red. From each 100-ft. station on north side, connecting lines were run to the opposite side, and small stakes, consisting of one-third of a 3-ft. lath, were driven at each interval of 100 ft. These connecting lines were designated A, B, C, etc., and each stake was plainly marked A-1, A-2 or B-1, B-2, and in this manner the fields were divided into 100 ft. squares with a stake at each corner.

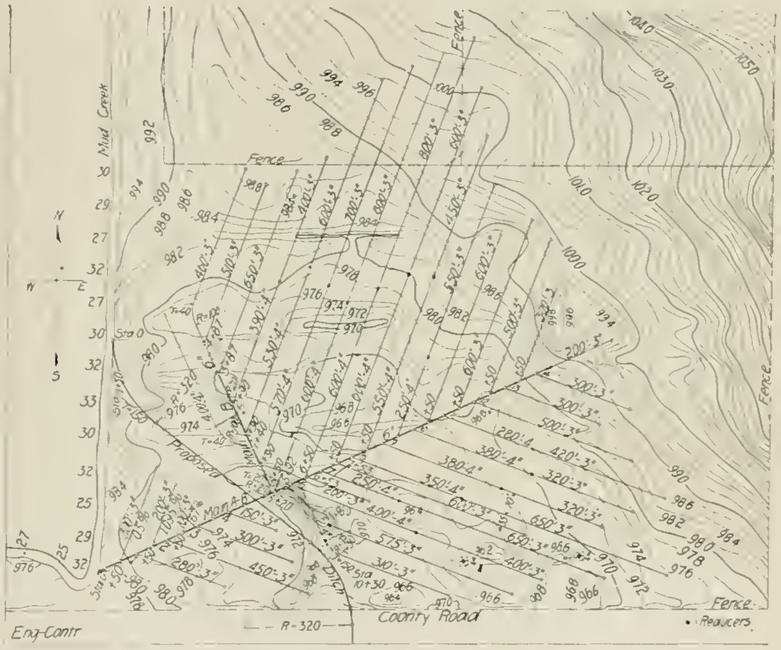


Fig. 1—Plan of Barton East Drainage System.

"A permanent bench mark, called No. 1, was set in a convenient place for future use and an elevation of 100 ft. assumed. From this No. 1 bench, levels were run with an 18-in. Gurley level around the field, and other permanent bench marks set, to be used to check field levels on later. After completing the circuit around the field, a reverse line was run and all of the bench marks checked. After establishing these bench marks, the elevations of the ground at the corners of each 100-ft. square were taken, two rodmen being employed, one going up one connecting line and the other up the one next to it, each being careful to keep his end laths with their colored pennants in line, so as not to get confused as to stakes. From field No. 1, in which the starting bench mark was located, a line of levels was carried some distance to field No. 2, and the same procedure gone through there.

"The field force on this topographical work consisted of the engineer and two assistants. On the level work two rodmen were employed, this being found more economical than the usual manner of having only one rodman. One Philadelphia self-reading rod and one home manufactured rod were used. This home-made rod was graduated, as described and illustrated in Mr. Elliot's valuable book on land drainage. All rod readings were taken to the nearest tenth of a foot on ground elevations. After the completion of the field work, the notes were plotted to a scale of 100 ft. per inch, and contours drawn for each difference in elevation of 0.2 ft. On these contour maps were planned and drawn the proposed systems of drainage.[†] The first system, called the Barton East Drainage System, was laid out and constructed during 1905. It comprises an area of 75 acres. After due consideration of other systems, the gridiron system of laying out the tile ditches, was adopted, with laterals cutting the contours as nearly at right angles as possible. All laterals were spaced 70 ft. apart, with the exception of two short laterals on the south side, which were spaced 35 ft. apart. The average depth of ditches was 3 ft. A grade of about 2½ ins. per 100 ft. was determined on for this main tile, the grades of the laterals running from over 8 ins. to ½ in. per 100 ft., according to the lay of the ground. On two of the south laterals, where the ground level was adverse to the grade line, the upper end of the tile had a depth of only 22 ins., a little too shallow if anything.

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[*] 439 Board of Trade Building, Omaha, Neb.

[†] From map shown in Fig. 1, it will be seen that contours are given every 0.2 ft. To locate these, the ground was staked off in squares of 100 ft. The cost of the combined topographic and location surveys was $1.45 per acre. This might have been reduced with the stadia, but Mr. Hicks states that, owing to the ground being covered with high weeds and undergrowth, the low spots could not be picked out. Using the method he did use, labor could have been saved by the automatic level rod described in Gillette's "Earth Work and Its Cost."—Editor.]

"In laying the system out, a field force of three men were employed, consisting of the engineer and two assistants. Stakes were set at each 100-ft. station, and also at each junction of a lateral with the main. Stakes were of hard pine, 1 in. thick, 2 ins. wide and 24 ins. long. All stakes were lined in with the transit and the side nearest the ditch put on line. This was done so that offsets could be measured more easily. The stakes were driven until their tops were exactly half a foot above the surface of the ground, and were marked on the front with the station number and on the reverse side was put the cut from top of stake to grade, in feet and inches. After all stakes were set, levels were run and a rod reading taken at each stake, the rod being held on the top of the stake. Profiles were plotted, the ground surface being shown half a foot lower than the stake elevations. On these profiles were drawn the grade lines and all cuts figured therefrom.

"In starting a ditch, the first operation was to stretch a wire on the ground at proper offset from inside face of each stake, to be used in getting the ditch straight. A man then went along with a skeleton spade and took up the sod and some 8 or 10 ins. of ditch. After him came a second man with the same kind of a spade, who took up the balance, down to within 5 or 6 ins. of the bottom grade line. The last man took up this bench and scraped the bottom with the tile spoon, testing for grade every few feet. This last man set the gage and wire and measured all offsets. The spades used were of the skeleton variety, it being found impossible to keep any other kind of a spade clean, see Fig. 2. The only trouble with these skeleton spades was, that as a rule, they were not made strong enough in the shoulder. Several were broken at this point, but it is only fair to state, that this might have been caused more by the manner in which the broken tools had been used, rather than to the weakness in the steel itself. It was found that men unaccustomed to the use of this character of spade, would invariably try to take too much depth of muck on tool.

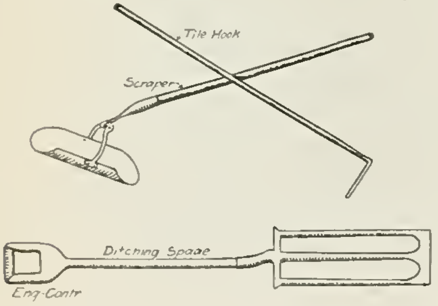

Fig. 2.

"The tile spoons, or scraper, used were of two sizes, 3 and 4 ins., see Fig. 2. These spoons were used exclusively to scrape bottom of ditches, and as long as water was found in the ditches, they cleaned themselves very satisfactorily. In half wet muck they proved very disagreeable to clean however. The user of one of these spoons had to learn the peculiar twist to give tool to free it from its load after lifting it above ditch, and unless this twist was given, the muck would always cling. These spoons leave the bottom of the ditch in a concave surface, into which the tiles rest securely, and preventing lateral displacement when tamping. The man using the spoon stood on the last bench in the ditch and spaded out some four or five feet and would then clean the bottom with spoon, drawing the tool towards himself.

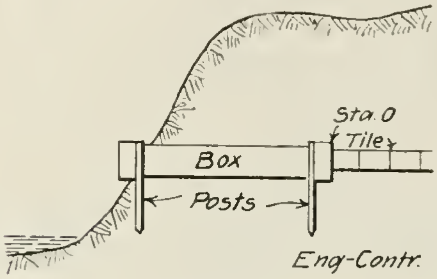

Fig. 3.

"The grade for the bottom of the ditches was obtained by the line and gage method. A light copper wire was stretched from one station to the other, the smaller cut was subtracted from the larger and the wire raised that amount above the lowest stake. The wire was then pulled taut and held firmly by special iron pins. The wire was now parallel to the proposed grade line, and the extension gage was set for the proper cut, and clamped, see Fig. 4. A steel square was provided so that the gage arm could be tested frequently. All cuts were marked on stakes in feet and inches, so that the ordinary 2-ft. rule could be used in making measurements. For 3-in. and 4-in. tile, at depths of from 3 to 4 ft., the ditch was cut 11 ins. wide. For 6-in. and 8-in. tile, the ditch was made 13 ins. wide for the same depths. For greater depths, more width was given. The soil through which the ditches were cut was so interwoven with roots that no caving of any sort occurred.

"After some 50 or 60 ft. of ditch had been graded ready for tile, the man taking up top, would go back and lay tile up to the breast, plugging the end tile with a piece of board to keep out all grass, twigs and dirt. It was found that a man, after a little experience, could lay 100 ft. of 3 to 6-in. tile in ditches from 3 to 4½ ft. deep, tamp a small amount of dirt around the sides of tile and plug all cracks that appeared too large, with pieces of broken tile, in fifteen minutes. The tile used was of the red, hard burned variety and was uniformly straight and true, very little turning being necessary to bring the edges together with a close joint. Each tile was placed with a tile hook, see Fig. 2.

"Considerable water was found in the ditches, but caused no serious inconvenience, in fact the man taking up the last bench and grading bottom, preferred to see it, as it made it easier to clean spoon, and indicated, by rippling, whenever a slight hump was left in the grade. The outlet of the main was protected by a white oak box, securely held in place by four cedar posts, see Fig. 3.

"Between six and seven rods of tile laid, or about 200 ft. of top per day per man was considered a good day's work. Men were paid $1.50 and board. Each day the foreman sent in a report card showing the number of feet of ditch opened, number of feet of each size tile laid, and number of elbows placed. After tile was laid and inspected, two men and a team and plow back-filled ditches, taking care to see that dirt packed in solidly and that it did not arch. The cost per acre was $22.81. Last year the yield per acre of corn was 90 bushels, this crop more than paying for the system. The engineering work was done by the writer, as was also the inspection, hiring of men, etc."

The cost per acre of $22.81 is rather high for this class of work, as farm land is drained in Illinois and other middle western states, where much of this class of work is done, for as low a cost as $10 and $12 per acre, but it must be remembered that this work was done in Nebraska, where but little drainage has been done, hence both materials and labor were higher, and the laborers had to be trained to the work. Then, too, these tile lines were laid but 70 ft. apart, and two laterals as close as 35 ft. Ordinarly 200 ft. is considered close enough spacing, but the work described by Mr. Hicks was not only done to drain the wet land, but also quickly to carry off the flood water that collected on the bottom land at times. This also added to the cost; consequently $22.81 was not excessive. There are records of this sort of work costing $30 per acre in very wet country.

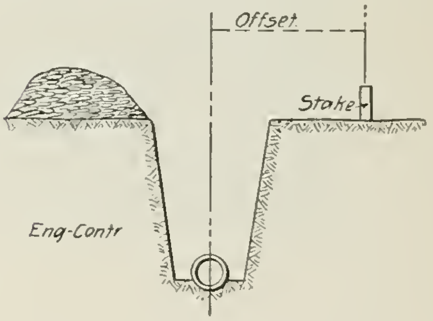

Fig. 4.

The following prices per 1,000 ft. of

various sizes of tile, were paid, on car at Gilmore, Neb.

3-in. hard burned farm tile	$18.70
4-in. hard burned farm tile	26.40
6-in. hard burned farm tile	52.80
8-in. hard burned farm tile	88.00
8-in. Y's, various sized branch, each	.50
6-in. Y's various sized branch, each	.40

The wages paid to men included board amounting for a ten-hour day to:

Foreman	$2.25
Laborer	2.00
2-horse team and driver	3.50

The material excavated was a rich black loam. More or less water was found in all the ditches. The ground was covered with a thick covering of docks, having tough roots that penetrated the ground for a considerable distance.

The dimensions of ditches were:

For 8-in. tile, depth over 4 ft. ditch 18 in. wide.
For 8-in. tile, depth under 4 ft. ditch 15 in. wide.
For 6-in. tile, depth over 4 ft. ditch 15 in. wide.
For 6-in. tile, depth under 4 ft. ditch 12 in. wide.
For 3 and 4-in. tile, depth over 4 ft. ditch 12 in. wide.
For 3 and 4-in. tile, depth under 3 ft. ditch 11 in. wide.

Mr. Hicks states that for an average depth of ditch of 3 ft. 6 in. the cost per cu. yd. for excavation averaged 21.2 cts., the cost varying from 17.7 cts. to 24.5 cts. After the ditch was dug it was shaped up, as described in Mr. Hicks' paper, with a tile spoon. This work cost, on an average, 2.44 cts. per lineal ft. of ditch, varying from a cost of 2 cts. to 2.83 cts. This gives an average cost per cu. yd. of earth excavated, for trimming and shaping of 20 cts. The cost of this work varies with the amount of water in the trench and, should the trench be made too deep, it becomes difficult to give it the proper shape, adding somewhat to the cost.

The trenches were back-filled by two men and a team with a plow, care being taken to see that the ditch was filled solidly, but no ramming was done. About 12 cu. yds. of earth were back-filled in a hundred foot section of an average trench. The cost for this work was 1 ct. per cubic yard. This gives a total cost of the earth work as follows per cubic yard:

Excavating trench	$0.21
Shaping trench	.20
Back filling	.01
Total per cu. yd	$0.42

The excavated earth was all put on one side of the trench to allow of being back-filled readily by a plow. When the material is the same throughout the entire depth of trench, this method is all right, but, if a different kind of earth is found under the surface soil then each class of material should be put by itself on one side of the trench, and the soil back-filled last.

The tiles were laid with a tile hook, shown in Fig. 2. With a little practice a man with one of these hooks can lay 100 lin. ft. of 3 or 4 in. tile in 15 minutes, while it will take 20 minutes to lay the same amount of 6 in. tile, and one-half hour for 100 ft. of 8 in. tile. This gives a cost per lin. ft. as follows:

3 or 4-in. tile	$0.0005 per lin. ft.
6-in. tile	.00066 per lin. ft.
8-in. tile	.001 per lin. ft.

The Y's were set by the foreman, the average time to set one being 5 minutes, making a labor cost per Y of 1⅞ cts.

The costs given for tile laying are for short time observations, although it is a fact that tile laying for this class of work is only done for short periods of time, as the ditches are dug in short sections, tiles laid and trenches refilled as quickly as possible. For these reasons, although some little time may be lost over that observed, the figures we have given are of value, and trained men in this line of work can do tile placing for these costs. The cost of distributing the tiles along the edge of the ditch is not included in the cost of laying them.

The total cost for the 75 acres of drainage was:

		Per cent.
Cost of surveys	$108.65	6.3
Labor	961.13	56.2
Material	641.26	37.5
Totals	$1,711.04	100.0

There were 25,154 lin. ft. of drain laid, making a cost of 6.8 cts. per foot, divided up as follows:

Surveys	$0.0043
Labor	.0382
Material	.0255
Total	$0.0680

The cost per acre was as follows:

Surveys	$1.448
Labor	12.815
Material	8.55
Total	$22.813

The tools to do this work cost about $20, not including the plow, as that was used on the farm.

For further information on tile drainage see Gillette's Handbook of Cost Data beginning at page 454.

A project is under consideration for reclaiming the plain of Konia, in Asia Minor. As proposed the irrigating water will be supplied by the lake of Bey-Chehir, which is situated 100 miles west of the city of Konia. Two small streams, Bey-Chehir-Souyou and Tcharchamba-Souyou, which carry off the overflow of the lake, will be canalized for a distance of 90 miles. A canal of 19 miles will be built around the low and marshy district of Karaviran, known under the name of Sogla-Gheul. Another canal of 12 miles will unite the above-mentioned rivers at the narrow gorge of Valikova. Several dams, three large reservoirs, an aqueduct, as well as numerous small canals, will have to be constructed for the distribution of the irrigating waters. It is calculated that 132,500 acres of soil will thus be opened to cultivation.

Cost of Making Railway Embankments with Wheelbarrows, Showing the Economy of Piece Work.

BY WILMER WALDO.*

Wheelbarrow work, generally known as "station work" on account of being let in small contracts covering one or two engineers' stations of 100 ft., is usually put up in places inaccessible to teams, or where the cost of team work would be excessive. This might be on account of the character of the ground in low wet places without drainage, or on account of stumps which would require expensive grubbing. The station men are, as a rule, allowed to take out their borrow pits at the most convenient places along the right of way not closer than 4 or 5 ft. to the toe of the embankment, providing that the different pits are connected with trenches. Economical station work does not run over 4 or 5 ft. in height, except in very good dirt, such as is found along the river banks where levees are constructed. In such cases, work has been put up economically with wheelbarrows as high as 18 ft. On railroad work, however, work is seldom contracted for in embankments higher than 4 to 5 ft., or in excavation of an equal depth. The disadvantage of working station men in any but very light cuts is the necessity of making the work continuous on account of drainage, which compels the men to take short contracts of less than one station.

The maximum yardage put up by one station man per day would not run over 25 cu. yds. under any conditions, and in very bad material may be as low as 10 cu. yds. or even less. Of course in estimating the cost of station work the incidental charges should be figured in addition to the contract prices. These consist generally of extra labor about camp, foreman and superintendence, hauling, interest on tools, and equipment, and at times grubbing. In some instances the grubbing is included in the price per cubic yard. The best station work is damp sand or loamy soil, which shovels well and is easy to place in the embankment. Hard black dirt, sticky earth or any character of work which is covered with water, or where the borrow pits are liable to flood, is apt to be expensive as station work, but considerably under the cost of the same work done with teams, providing it could be done at all with teams. It is interesting to find that team work similar and adjacent to the station work shown in the tables was done at an average cost of 27½ cts. per cu. yd.

Where a great many men are employed under one general foreman or superintendent, of course the general expense is considerably less per cu. yd.; but, as often happens, the camp may be depleted by different causes, such as bad weather, or bad work, when the general expense is very high in proportion to the contract price.

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*Civil Engineer, Houston, Tex.

The work upon which the following costs are based was done in South East Texas during the months shown, and embraced nearly every kind of material, the majority of it being in low swampy country, subject to overflows in one season and getting very dry and hard in others. A large part of it was sticky clay where the borrow pits were filled with grubs, stumps and roots, requiring the constant use of a mattock. Even in places where the stumps are thick, if the earth shovels well without the use of a mattock or any breaking, station work can be done cheaper than the ordinary team work under good conditions.

The prices vary according to the class of the work or the availability of men. When the men are plentiful, even in bad work, the price is less. The exact time during which a man is engaged on a contract or the net earnings per day to him is difficult to ascertain. However, table No. 1 shows these figures as nearly as it is possible to get at this. Table No. 1 is compiled from data which show a wide range in material, season and ability of men engaged. Those showing practically no wage earned are not experienced station men. It is generally noticed that the men engaged regularly in this kind of work will usually finish a contract, even though it be a bad one which promises no earnings.

There were some fifty Austrians and other immigrants engaged for this work by the day. However, after a few days they requested work by contract. Then they put up their stations at practically the same cost and with the same efficiency as the old-timers, the work apparently being of a class to which they were somewhat accustomed.

During the summer months, the custom among these men is to do their work partly at night, laying off through the heated part of the day. Station men are not available in great numbers in seasons of extreme heat or cold, preferring to follow the mean temperature either north or south. They migrate in pairs and often work in partnership, but it is customary to furnish separate estimates of equal value to the two partners. The contract and estimate system in this work does away with a general pay day, which keeps the majority of the men working all the time and eliminates the timekeeper and disagreements in regard to time. The station man expects payment of his estimate immediately upon completion and acceptance, which is arranged by a draft on the nearest bank, unless it is too far away. If no bank is available, the paymaster takes up all estimates due every fifteen days, or any authorized party can take them up at any time on the work.

[The haul on the material in building railroad embankments 4 or 5 ft. high in this manner is seldom over 25 ft. from the center of mass in the beam ditches to the center of mass in the embankment, but in order not to be changing runways continually 10 and 15 ft. are sometimes added to this distance. The wheelbarrows are generally run on boards laid down for the purpose.

It will be noticed that nearly all the station men made daily wages amounting to more than $1.50, while one-third of them made more than $2.00, one man going up to $2.82. This man handled 20 cu. yds. per day, loading and transporting it in a wheelbarrow, but it will be noticed that the bank was a low one, as the cubic yards in a 100-ft. section was only 91.—Editor.]

TABLE NO. I. MEMORANDUM REPORT ON STATION MEN'S WORK, SECTIONS 1 TO 8.

Estimate Number.	Stations.	Cu. yds.	Rate per cu. yd., cts.	Gross.	Men.	Began.	Finished.	Actual days worked.	Average yards moved per man—day.	Average pay per man—day.
18	1087–88	15 7	13	$ 2.15	3	5–6	5–7	1	5.2	$0.71
19	1308–09	307	13	39.92	2	4–20	5–8	12	12.8	1.66
20	1276–78	54.8	13	7.13	.....	.....	.....	.....	.....	.....
....	1283–4	105.0	15	15.75	1	4–21	5–8	16	9 9	0 98
21	1143–4	274 4	15	41.16	1	3–18	5–9	16	17.1	2.57
22	1352–3	99 6	14	13.44	1	4–28	5–9	7	14.2	1.92
23	1345–46	91.	14	12.74	1	5–4	5–8	4½	20.0	2.82
24	1307–8	323 4	13	42.04	2	4–20	5–10	11	14.7	1.13
25	1303–4	265.8	13	34.45	2	4–30	5–11	10	13.3	1.72
26	1305–6	307.3	13	39.95	1	4–13	5–12	20	15.3	1 95
27	1306–7	328.5	13	42.71	1	4–23	5–14	22	14.9	2 13
28	1301–3	571.5	13	74.29	1	4–13	22	14.9	2.13	1.25
29	1358–9	101.7	14	14.24	1	5–4	5–16	11	9.2	1.29
30	1357–8	97.8	14	13.69	1	5–4	5–17	9	10.8	1.63
31	1310–11	124.6	13	16.20	1	5–4	5–19	10	12.5	1.62
32	1144–5	256.9	15	38.54	1	5–5	5–21	15	17.1	2.57
33	1142–3	249.2	15	37.38	1	4–27	5.21	18	13.8	2.07
34	1281–83	192.2	15	38.83	1	4–30	5–22	18	10.7	2.15
35	1353–4	99.3	14	13.90	1	5–9	5–22	6	16.5	2.31
36	1268–70	123.4	13	16.04	1	4–8	4–26	19	6.5	.84
37	1351–2	118.6	14	16.60	1	4–27	5–22	12	9.8	1.40
38	1359–60	105.4	14	14.76	1	5–4	5–30	10	10.5	1.48
40	1361–63	118.7	14	16.62	1	5–13	6–2	10	11.9	1.66
42	1363–64	110.7	14	15.5	1	5–16	5–2	7	15.8	2.21
43	1342–45	248.7	14	34.82	1	5–10	6–4	20	12.4	1.74
44	1354–55	108.9	14	15.25	1	5–22	6–5	10	10.9	1.53
26	33	4800.2	14½	678.1				355.5	327.0	45.94

The costs for station men in Camp No. 12 were as follows:

1906. June, July, August, September, October, November, December, January to February 22, 1907.

To amounts paid station men—		
10313.6 cu. yds. @ 13c......	$1,340.77	
1636.6 cu. yds. @ 13½c....	220.94	
2754.2 cu. yds. @ 14c......	385.58	
20189.4 cu. yds. @ 15c......	3,028.41	
6465.3 cu. yds. @ 15½c....	1,002.12	
605.7 cu. yds. @ 16c......	99.94	
209.8 cu. yds. @ 17c......	35.66	
1150.8 cu. yds. @ 18c......	207.14	
563.0 cu. yds. @ 20c......	112.60	
4508.8 cu. yds. @ 25c......	1,127.20	
48397.2		$7,560.36
To amounts paid labor for grubbing, driving team, etc., moving and about camp	$ 686.00	
Team time	166.80	
Foreman in charge of work and camp	620.00	
Superintendent	62.66	
		1,535.46
		$9,095.82
To amounts paid cook.....	$ 516.60	
Flunkey	108.15	
Groceries	2,046.44	
	$2,671.19	
Credit.		
By board collected from station men.$1,240.05		
Board collected from labor, foreman, cook, etc... 763.90	2,003.95	
		667.24
To interest on investment of tools, etc.		347.90
		$10,110.96

Cost per cu. yd. for grubbing and labor around camp	$0.0142
Cost per cu. yd. for foreman and superintendent	0.0141
Cost per cu. yd. for hauling, etc., and excess of cost of mess over board collected	0.0173
Cost per yard of interest on investment in tools, etc.	0.0072
Average price paid per cu. yd. as per contracts	0.1562
Total per cu. yd..................	$0.209

[It is of interest to note that a gang of laborers, being paid by the day, working under a foreman, moved 1,549 cu. yds. at a cost of $387.34, making a cost per cu. yd. of 25 cts. This was 4 cts. more than the cost of the work when let by contract to the men. This clearly indicates that men work harder when they know that their pay depends upon the number of cubic yards they can excavate a day.—Editor.]

According to a recent consular report the city of Manchester, England, has about 700 miles of paved streets. All of the public streets are paved with stone sets, and the foothpaths are paved with gritstone flags, not less than 3 ins. thick, obtained from quarries about 20 miles distant. About one-half of the mileage of carriage ways is paved with gritstone sets, the remainder being paved with granite or syenite stone. The carriage ways of the streets in the central part of the city and other first-class streets are paved with granite sets. When the sets are laid they are well rammed and small stone chippings are brushed into the joints, which are then flushed with a mixture of pitch and creosote oil or tar. The first cost of paving old foundations with new granite sets 3 to 3½ in. wide, 6 ins. deep, and 5 to 8 ins. long is about $2.63 per square yard, and under average conditions this pavement will last about 25 years before it is worn out. The average first cost of paving the carriage way with new grit sets on old foundations is about $1.82 per square yard. The cost of flagging the footpaths with 3-in. gritstone flags is about $1.82 per square yard.

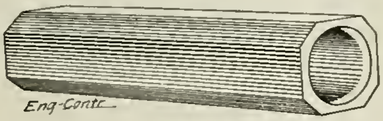
Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Methods of Laying Conduit Systems

Mr. W. F. Roberts at a recent meeting of the Engineering Association of the South, read a paper on the methods of laying underground conduits for electric wires. We abstract the following from it:

"What kind of conduit should we lay?" For the benefit of those who have never given conduit work any thought I shall briefly describe some of the most prominent kinds of duct, many of which have become obsolete. These may be roughly divided into three classes:



Single Tile.

1. Conduits of vegetable material.
2. Conduits of metal material.
3. Conduits of silicious material.

In the first class there are:

(a) Valentine creosoted box.

(b) Wyckoff creosoted tube or pump log.

(c) Paper or fiber conduit.

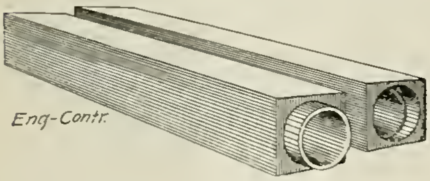
In the second class there are:

(a) Johnston sectional cast-iron conduit.

(b) Wrought-iron pipe laid in hydraulic cement.

(c) Wrought-iron pipe laid in asphalt cement.

(d) Cement-lined wrought-iron pipe.



Creosoted Wood Tile.

(e) Steel or wrought iron laid in earth.

In the third class there are:

(a) Dorsett—a combination of coal tar, pitch, and gravel (one of the oldest: considerable laid in Chicago).

(b) Lake conduit—terra-cotta sectional (principally laid in Washington, D. C.)

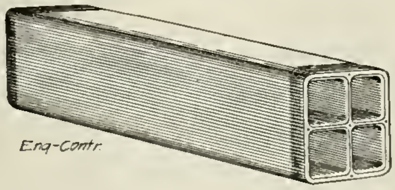
(c) Cement and stone conduit.

(d) Vitrified clay conduit, both multiple and single tile.

Most of the subway laid to-day is either single or multiple clay duct, fiber, or creosoted wood. All of these give good results, and often the preference is caused by the market price of duct material and freight from factory to points of installation. There are some conditions besides cost of material and installation that should dictate the kind of duct to be laid. For instance, in localities where much water has to be contended with, creosoted wood duct is most practical; in streets crowded with underground pipes and where outside forces or attacks are likely to be numerous, the single clay tile, which is the highest type of sectional subway, should be laid.

The cheapest form of standard conduit is multiple tile laid similar to drain tile in the ground without special foundation. In view of the fact that the others are better and cheaper, some people still dare to lay bare iron and steel pipe, disregarding the electrolytic action commonly known as electrolysis.

The conduit being laid for the Cumberland Telephone Co. in Nashville by G. M. Gest is single clay tile, mostly Camp. Some of it, and that laid around the branch exchanges, Hemlock and Walnut, is McRoy tile. This tile is laid in a matrix of cement upon a foundation of at least 3 in. of concrete and covered on the sides and top with concrete in a like manner. As has been said before, this is considered the highest type of conduit. Its flexibility in weaving around and over pipes in congested districts makes it the most desirable system, generally speaking. There is also an additional precaution against outside forces, such as picks and shovels, made by laying a creosoted plank on top of the concrete covering the ducts. Where there is a good concrete covering over ducts, I doubt if the expense of creosoted plank is compensated by the good it does.



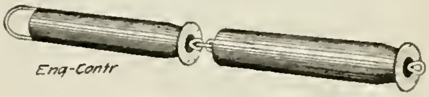
Multiple Tile.

The telephone company recently completed in Evansville, Ind., an underground system built of multiple tile, with single duct laterals. (Multiple tile is considered by some engineers as equal to single tile.) The excavation is made in the usual manner, which is 6 in. wider than the tile. This is to allow the concrete foundation, which is 3 in. thick, to project on either side of the duct.

The joints of multiple tile are made rigid by the use of dowel pins. After the ends of the tile have been fitted close, a narrow strip of burlap or muslin is wrapped around over joints and same covered with cement. This class of duct is sometimes laid without concrete foundation and cover, and, again, with an entire concrete encasement, according to the condition of the soil, etc.

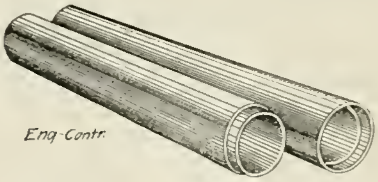
A new method of laying multiple tile, which I have not as yet seen tried, is to omit concrete foundation and place same over the top and partly down the sides in the shape of the letter "U." The concrete thus arranged is supposed to act as a beam to prevent settling on account of giving way of bottom.

Fiber conduit (and the one to which I am a bit partial) is laid in several different ways, according to the ideas of the different engineers. One method which is being tried by the Nashville Railway & Light Co. is to set forms in the excavation and place the bottom and side concrete in position, which is to act as a foundation and encasement, before the fiber is placed, the fiber being separated both vertically and horizontally by thin strips of wood. The entire space between side walls and around fiber is filled with cement grout, and the top is covered with concrete.



Mandrel.

Another method (and the one generally used) is to space the duct from ½ to ¾ in. apart, and to fill between same with concrete made of fine crushed stone and on the outer edges with a coarser concrete simultaneously. Thus the whole structure is built up in layers. Best results are obtained in each case by first dipping the spigot end of the fiber in hot jointing compound before coupling. Iron pipe, when laid with concrete encasement, is usually spaced ½ in. apart.



Fibre Conduit.

Creosoted wood duct is generally laid without any special foundation, and is usually covered before refilling with a creosoted plank. The spigot ends should fit tight, but not to such an extent that they split when driven home. This class of duct has generally given satisfaction, and is recommended very highly where there is a fear of trouble from future blasting or where the soil is so wet the use of concrete is difficult.

Clay tile (both single and multiple), fiber, creosoted wood, and iron or steel pipe figure almost exclusively in the conduit world to-day. There have been, and are to-day, several types still in the experimental stage.

There are quite a variety of manholes, handholes, subsidiaries, or surface boxes, differing according to the services to be rendered. In telephone work they are standardized, both as to shape and size, contingent, of course, to the surrounding underground obstacles and the number of ducts entering same. Some engineers are of the opinion that best results in regard to arrangement of cables can be obtained with rectangular holes, while others prefer round ones. It is my opinion that the oval and acorn-shaped holes meet the requirements best and are less expensive than other types. Handholes—or "surface boxes," as they are very frequently called—are usually made very small, as the name would imply. Some companies classify small manholes as handholes.

The depth, or head room, of an ideal manhole is 6 feet. Conditions—such as drainage, etc.—often necessitate this head room being cut down. There is apparently an argument against making manholes so deep, as most of the work in them is done in a sitting posture, such as splicing and testing cables. However, best results are usually obtained when working with best surroundings; for in rodding or pulling in cable, crowded manholes add to the cost of such work.

The construction of manholes and handholes is either of brick and brick roofs, brick and concrete roofs, or concrete walls and roofs. We find that in cities where water, gas and sewer pipes are numerous, brick manholes, with reinforced concrete tops, are the most economical. We can change the shape and size very easily, as well as include necessary water and gas pipes in the brick walls, which is more or less expensive and difficult with concrete forms. Manholes with brick roofs are usually supported with "I" beams and angle irons, while some are supported with old railroad irons. Concrete roofs or covers for manholes are reinforced in many different ways. Some companies use the regular steel bars; others, steel strand and woven wire.

The telephone company is using in Nashville old 4½-in. railroad rails. In some instances the duct is laid flush with the inside of manhole walls, and in many cases it is recessed in the walls, the brick being cobbled and plastered with cement in order to give a rounded surface for the cables to turn against. This round surface is also obtained by the use of round-nose brick.

I have given you a brief outline of conduit work in general, and now will take up some features of the Nashville system. The remainder of my remarks may seem somewhat disconnected, for I will try to answer some of the questions asked by many during the progress of the work.

The first is the mandrel. This consists of two round pieces of wood, each 2 ft. long, whose diameter is ½ in. smaller than the conduit. These blocks are coupled together, as you see by the one I hold in my hand. On the end of the front block is a handle made to draw it forward, and on the back ends rubber washers. The mandrel, with washers, is drawn through the tile to cut out the cement that gets in while jointing the tile. After the conduit is finished, it is tested by drawing through it a hard wooden mandrel, fitting the tile reasonably close.

"How are the wires put in?" Underground wires, of both telephone and telegraph, are placed in lead-covered cables, containing from 200 to 600 pairs of conductors. The rope used to draw cable into the conduit is threaded through by means of jointed rods similar to those used for clearing sewers. These are shoved from one manhole to another. The cable reel is placed over one manhole, and a capstan, or windlass, with the necessary pulleys and graces, at the next adjoining manhole. Cables are sometimes drawn in with an electric motor, gasoline engine, and with a team of horses. The different sections are tested out and connected together by expert men in their particular line.

"In what way will you get the wires to the subscribers?" In many instances by running laterals from the manholes to the cellars of office buildings and by running pipes up the walls and distributing the cable in pairs along the windows and cornices.

"Can a leak be repaired between manholes?" Yes, by substituting a new piece of cable the length of the block or section.

"Why are they placing the concrete partition between the two companies?" To separate the high potential from the low potential and to insure against induction as far as possible under the existing conditions.

"Doesn't the water get into your manholes and conduits?" It certainly does; and where drainage is possible and can be obtained at reasonable cost, it is provided.

"What's the necessity of so many manholes? It looks like one at each corner, to be used by all companies, would be enough." Such a proposition is impracticable, for many reasons. It would be dangerous for any one not familiar with the power companies' wires to enter a manhole containing same. It would also be very difficult to arrange the network of cables so that they would be available for tests and repairs if all were in the same hole.

The Potable Water Commission of the City of Mexico is having constructed three circular reservoirs, 100 meters in diameter. The reinforcement required for the construction of these reservoirs is being furnished by the Expanded Metal & Corrugated Bar Co., of St. Louis, Mo., an order for 2,600 tons of corrugated bars having been placed with the company.

Building Operations in Leading Cities of the United States in 1905 and 1906.

Some interesting statistics on building operations in the leading cities of this country are given in a bulletin on the clay working industries in the United States in 1906, recently issued by the U. S. Geological Survey, and the matter in this article has been taken from that bulletin. Statistics were obtained from 49 cities and it was found that while the number of permits issued decreased from 185,806 in 1905 to 180,574 in 1906, a loss of 5,232 or 2.81 per cent, the cost of the buildings erected under these permits increased $34,090,096 or 5.29 per cent. In this connection it is interesting to note that the increase in cost of buildings erected in 1905 over those erected 1904 was $175,960,866.

The building operations in the leading cities of the United States in 1905 and 1906 are shown in Table 1. In some instances more than one building is erected under the same permit; the cost given in the table is that of the building or buildings erected.

It will be noted that 17 cities showed a decrease in the cost of the buildings erected, the largest decrease being in the case of New York. There appears to be no general reason for the decrease in the cost of the buildings in these cities, some of the causes being local strikes, high cost of labor and materials, high rates for money and over-production of buildings in 1905.

San Francisco as was to be expected in view of the destruction caused by the earthquake and fire of April 18-20, 1906, had the greatest increase. The figures for this city from May 19 to Dec. 31 show that permits were issued to erect buildings to cost $34,927,396, an increase of $16,658,643 over 1905.

Although unavoidable delays retarded building operations so that comparatively little progress was made until the fall, this is a remarkable showing and is a great credit to the city.

Where normal conditions prevailed, Boston showed the largest actual increase, $510,699,994, while Kansas City, Kan., showed the largest proportional gain, 209.07 per cent.

On the basis of one building to a permit, which is generally the case, the average cost for each building in 1906 was $3,758; in 1905 it was $3,469; in 1904, $3,337; and in 1903, $3,066. The average cost per permit in the leading cities was as follows: New York, $18,076; Brooklyn, $3,951; Chicago, $6,081; Philadelphia, $2,278; San Francisco, $6,143; St. Louis, $3,331; Boston, $6,931; Los Angeles, $1,977; Pittsburg, $4,112; Detroit, $3,234.

Statistics were also obtained from 35 leading cities on the value and number of the brick and stone or fireproof buildings erected as compared with wood buildings. The number and value of these buildings erected in 35 cities in 1906 were as follows:

	Brick and stone.		Wood.	
	Number of permits.	Value.	Number of permits.	Value.
Altanta, Ga.......	134	$ 2,189,327	1,336	$ 2,167,921
Boston, Mass......	479	14,255,431	1,156	5,855,231
Brooklyn, N. Y....	5,802	55,586,860	2,782	9,479,465
Chicago, Ill.......	5,967	58,238,393	4,674	6,470,932
Cincinnati, Ohio...	503	4,691,400	748	1,617,290
Cleveland, Ohio...	694	6,694,580	3,582	4,953,193
Columbus, Ohio...	594	2,193,075	1,125	1,687,300
Dayton, Ohio.....	126	1,319,080	910	1,411,870
Grand Rapids,Mi'h	73	698,681	763	1,175,424
Hartford, Conn....	127	2,748,900	136	637,800
Indianapolis, Ind..	721	1,954,594	1,903	3,030,592
Kansas City, Mo...	413	5,544,000	1,621	3,783,710
Los Angeles, Cal...	273	6,489,367	6,564	10,536,473
Louisville, Ky.....	201	2,877,015	1,415	1,566,530
Lowell, Mass......	12	304,109	164	421,155
Memphis, Tenn....	154	2,193,458	1,373	1,782,214
Milwaukee, Wis...	179	3,532,328	1,633	4,433,820
Nashville, Tenn...	259	2,056,750	458	484,579
Newark, N. J....	155	5,067,445	1,791	4,740,929
New Haven, Conn	87	1,571,600	257	1,183,100
New York, N. Y..	2,588	129,927,135	1,279	5,673,110
Omaha, Nebr.....	157	2,614,400	712	1,493,560
Philadelphia, Pa..	10,987	33,034,770	67	123,450
Providence, R. I..	53	1,187,400	719	1,979,400
Reading, Pa......	884	1,631,245	......	....
Richmond, Va....	293	1,549,576	337	333,207
Rochester, N. Y...	159	2,414,739	779	3,031,702
St. Louis, Mo.....	2,640	27,223,734	3,956	993,332
San Francisco, Cal.	599	16,374,092	3,258	14,458,894
Scranton, Pa......	60	538,015	518	1,197,800
Seattle, Wash.....	81	5,001,150	3,170	4,751,329
Syracuse, N. Y....	81	1,564,959	511	1,360,737
Toledo, Ohio......	110	1,629,997	1,542	2,525,960
Washington, D. C.	1,349	9,405,200	1,181	1,089,177
Worcester, Mass...	72	1,135,295	394	1,067 105
Total.......	37,066	415,438,100	52,814	107,498,291

It will be noted that of the total number of permits or buildings 37,066, or 41.24 per cent, were brick or stone buildings, and 52,814 or 58.76 per cent were wooden buildings. The total value of the new buildings in the cities in the above table was $522,936,391. Of this $415,438,100 or 79.44 per cent represented buildings of stone, brick or other so-called fireproof material, and $107,428,291, or 20.56 per cent represented wooden buildings. The number of wooden buildings even in these large cities is considerably greater (42.49 per cent) than the number of fireproof buildings, but the value of the wooden buildings was only a little more than one-fourth of that of the fireproof buildings. The average value of each of the fireproof buildings was $11,208, while the wooden buildings averaged only $2,035.

New York leads in the value of its fireproof buildings, the average value per building being $50,204. There were no wooden buildings erected in the borough of Manhattan, but in the Bronx 1,279 were erected in 1906, with an average value of $4,436. Chicago was second in value of fireproof buildings, though the average value per building was but $9,760, and Brooklyn was third, with an average value of $9,581. Philadelphia reported the largest number of brick buildings, 10,987, of an average value of $3,007. In St. Louis the average value of fireproof buildings was $10,312.

In wooden buildings San Francisco reported the largest outlay, $14,458,894, an average of $4,438 per building, while Los Angeles reported the largest number of wooden buildings, 6,564, an average of $1,605 per building. The wooden buildings erected in 1906 in Brooklyn were valued at $9,479,465, an average of $3,407 each, and Chicago erected wooden buildings at a cost of $6,470,932. Reading, Pa., is the only city in the above list reporting no wooden buildings erected during this year, there being a city ordinance prohibiting the erection of buildings of that type.

Table 1. BUILDING OPERATIONS IN THE LEADING CITIES OF THE UNITED STATES IN 1905 AND 1906.

City.	1905		1906			
	Number of permits or buildings.	Cost of buildings.	Number of permits or buildings.	Cost of buildings.	Gain (+) or loss (−) in 1906.	Percentage of gain or loss in 1906.
Allegheny, Pa............	816	$ 2,412,570	713	$2,080,634	− $ 331,936	− 15.95
Atlanta, Ga.....	3,499	3,312,931	3,741	5,156,149	+ 1,834,218	+ 55 63
Baltimore, Md.....	2,976	16,638,200	2,826	12,619,970	− 4,018,230	− 24.15
Boston, Mass....	2,249	12,364,747	3,328	23,064,741	+10,699,944	+ 86 53
Brooklyn, N. Y.....	19,679	73,017,706	18,083	71,442,148	− 1,575,558	− 2.15
Buffalo, N. Y.......	2,886	7,401,006	2,867	8,686,030	+ 1,285,024	+ 17.36
Cambridge, Mass.....	470	1,659,875	457	1,458,105	− 201,770	− 12.15
Chicago, Ill. ...	16,150	65,000,000	10,641	64,709,325	− 290,675	− .44
Cincinnati, Ohio.........	3,307	9,709,450	2,130	7,065,746	− 2,643,704	− 27.22
Cleveland, Ohio..........	4,976	9,777,145	7,553	12,972,974	+ 3,195,829	+ 32.68
Columbus, Ohio..........	2,133	5,107,400	2,025	4,006,175	− 1,101,225	− 21.56
Dayton, Ohio......	1,176	2,350,000	1,223	2,898,380	+ 548,380	+ 23.33
Denver, Colo..........	2,455	6,374,537	2,461	7,000,996	+ 626,459	+ 9.82
Detroit, Mich.........	4,021	10,462,100	4,105	13,275,250	+ 2,813,150	+ 26.88
Fall River, Mass. ...	291	885,625	275	939,325	+ 53,700	+ 6.06
Grand Rapids, Mich	1,486	2,145,265	1,250	2,181,307	+ 36,042	+ 1.68
Hartford, Conn....	664	3,076,092	652	3,732,915	+ 656,823	+ 21.35
Indianapolis, Ind....	4,041	7,225,325	3,825	5,530,998	− 1,694,327	− 23.44
Jersey City, N. J.....	1,352	3,330,522	1,503	4,334,244	+ 1,003,722	+ 30.13
Kansas City, Kas....	818	1,172,093	541	3,622,670	+ 2,450,577	+209 07
Kansas City, Mo...	4,437	10,917,024	3,993	10,765,480	− 151,544	− 1.38
Los Angeles, Cal....	9,543	15,382,057	9,358	18,502,446	+ 3,120,389	+ 20.28
Louisville, Ky......	2,255	4,506,382	2,916	5,116,917	+ 610,355	+ 13.54
Lowell, Mass......	251	878,090	353	901,745	+ 23,655	+ 2.69
Memphis, Tenn.....	2,882	3,554,883	2,549	4,346,767	+ 791,884	+ 22 27
Milwaukee, Wis......	4,166	9,806,729	3,782	9,713,284	− 93,445	− .95
Minneaoplis, Minn.	4,825	8,905,205	4,724	9,466,150	+ 560,945	+ 6.29
Nashville, Tenn....	5,636	2,609,889	5,124	2,840,212	+ 230,323	+ 8.82
Newark, N. J.....	2,379	10,214,615	1,946	10,411,328	+ 196,713	+ 1.92
New Haven, Conn..	467	2,143,240	687	3,018,890	+ 875,650	+ 40.85
New Orleans, La.....	1,970	4,070,077	....	5,098,773	+ 1,028,696	+ 25.27
New York, N. Y....	10,043	178,032,527	8,573	154,964,655	−23,067,872	− 12.95
Omaha, Nebr.......	885	4,387,464	1,093	4,273,050	− 114,414	− 2 60
Philadelphia, Pa....	15,933	34,416,745	17,872	40,711,510	+ 6,294,765	+ 18.28
Pittsburg, Pa.......	4,273	17,159,443	3,738	15,370,047	− 1,789,396	− 10.42
Providence, R. I.......	1,358	4,562,950	1,350	3,983,300	− 579,650	− 12.70
Reading, Pa.......	1,548	2,791,065	1,347	1,645,135	− 1,145,930	− 41.05
Richmond, Va.........	451	1,501,000	740	2,504,895	+ 1,003,895	+ 66.88
Rochester, N. Y.......	1,707	5,676,624	1,373	6,175,478	+ 498,854	+ 8.78
St. Joseph, Mo........	877	670,195	898	1,052,746	+ 382,551	+ 57.08
St. Louis, Mo........	8,285	23,434,734	8,988	29,938,693	+ 6,503,959	+ 27.74
St. Paul, Minn......	1,657	8,536,345	2,813	9,537,449	+ 1,001,104	+ 11.72
San Francisco, Cal	5,420	18,268,753	5,686	34,927,396	+16,658,643	+ 91.18
Scranton, Pa.....	1,144	2,212,929	1,097	2,174,075	− 38,854	− 1.75
Seattle, Wash..........	7,677	6,704,784	7,194	11,875,397	+ 5,170,613	+ 77.11
Syracuse, N. Y..........	837	2,275,610	1,057	3,313,261	+ 1,037,651	+ 45.59
Toledo, Ohio..........	1,139	3,087,142	1,759	4,696,058	+ 1,608,916	+ 52 12
Washington, D. C..........	7,577	12,308,943	8,453	11,668,347	− 640,596	− 5 20
Worcester, Mass..........	739	2,182,840	912	2,939,403	+ 756,563	+ 34.65
Total.....................	185,806	644,620,873	180,574	678,710,969	+34,090,096	+ 5 29

Data on Street Cleaning at Albany, N. Y.

The street cleaning of Albany, N. Y., is effected by three methods: Machine sweeping of improved streets; hand cleaning of cobblestone streets and alleys and hand cleaning in the business district. All of the work is done by city forces, and the city owns the sweeping machines and street sprinklers and hiring necessary teams and drivers.

In the principal business districts the asphalt pavements and granite cross walks are kept cleaned and waste paper picked up at a cost of about $4,100 a year. The following regular gang is employed for this work, the wages being $1.75 per day:

2 men cleaning cross-walks...........	$ 3.50
3 men cleaning asphalt................	5.25
2 men picking up waste paper.........	3.50
Total daily expense....................	$12.25

The cobblestone pavements, of which there is a total area of 229,229 sq. yds., are cleaned by hand hoes or broom, at the following daily expense:

1 foreman, at $2.35.....................	$ 2.35
10 men, at $1.75.........................	17.50
1 horse and driver for sprinkler, at $3.50	3.50
Total	$24.35

The pavements are cleaned for a period of eight months at a total cost of about $4,800.

The principal part of the street cleaning work is effected by machine sweeping, the areas and kinds of pavement covered being as follows:

	Sq. Yds.
Granite block pavements............	560,623
Vitrified brick pavement............	458,733
Sheet asphalt	173,094
Asphalt block	14,500
Total	1,206,950

This area is swept twice a week during eight months of the year, or from about April 1 to December 1. The force engaged in machine sweeping consists of four gangs, each under a foreman, and made up of one street sprinkler, two machine sweepers and 12 men. Each gang has its regular district to cover day or night as the case may be.

The sweeping is done in the usual manner, the pavements first being lightly sprinkled with water to lay the dust and then swept with the machines, the dirt being pushed by the later from the center of the street to each of the gutters. The men then sweep the dirt into piles along the gutters at intervals of about 25 ft. Machine cleaning in the business district is done only at night.

The daily labor cost of collecting the dirt in piles is as follows:

8 teams and drivers for sweeping machines, at $5	$40.00
4 teams and drivers for sprinklers, at $5	20.00
4 foremen, at $2.35	9.40
48 men, at $1.75	84.00
Total daily labor cost	$153.40

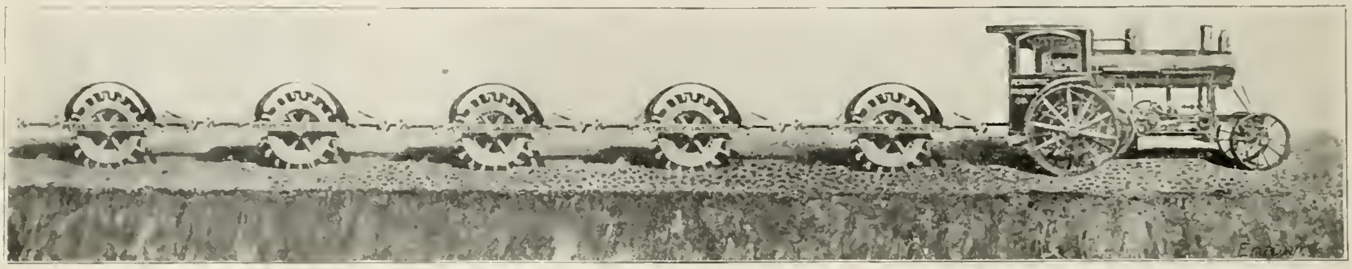
The above force is employed about eight months, the total yearly expense for labor being about $32,000. The cost of repairs to sweeping machines and sprinklers, cost of new brooms and refitting old brooms and other incidentals amounts to about $4,000 per year, making a total cost for sweeping the dirt into piles amount to about $36,000. As the total amount of pavement swept over each amounts to about 85,000,000 sq. yds. the cost of sweeping the dirt into piles is about 42 cts. per 1,000 sq. yds. This does not include the cost of shoveling the dirt from the piles into wagons and conveying it to dumps or other places where it is used for filling. This work is done by contract, the price for 1907 being $11,500. There are eight public dumps in various parts of the city which receive street dirt, ashes and other refuse, and are leveled off and cared for by 9 men at an expense of $15.75 per day, or about $5,000 per year.

In explanation of the rather high cost of cleaning the paved streets it may be stated that a great many of the streets of Albany have very steep grades. The large amount of granite block pavement also added to the cost.

In connection with the hydro-electric scheme on the Thelum river in Kashmir, in northwest India, now nearing completion, it is interesting to note that contracts for the entire hydraulic and electrical equipment were placed with firms in the United States. The conditions under which the plant was installed are somewhat out of the ordinary as the specifications stipulated that no single piece of machinery should weigh more than 4 tons when packed, for the reason that there is 200 miles of road transportation, including a lift over a range of mountains 8,000 ft. high.

Compacting Earth for Subgrades of Roads and Pavements and for Reservoir Embankments with a Tamping Roller.

We illustrate herewith a traction engine drawing a train of five Petrolithic rolling tampers, or tamping rollers. This type of roller differs from all smooth or grooved rollers, not only in appearance, but in the method of its operation and in the results secured. It resembles in action the compacting of earth by the pounding of the feet of animals, which had long been known to be the most effective way of compacting reservoir embankments. The face of each roller is studded with numerous "iron feet" which do the tamping. In road or street work, the subgrade to be compacted is first loosened with a plow to a depth of about 6 ins. When the rolling tamper is drawn over this loosened earth, its iron feet sink into it nearly to their full length, and thus begin the process of compacting the earth *at the bottom*. Successive trips of the roller over the earth result finally in a mass so thoroughly compacted that the "iron feet" no longer sink into it, but ride on top as shown in the photograph. The ordinary smooth roller compacts the earth in a wholly different manner by starting its compression from the top downward. Hence the top of a thin layer of loose earth may be well compressed by a smooth roller, while the bottom of the layer is very poorly compressed. Realizing this defect of smooth rollers, inventors produced grooved rollers, which are really a series of smooth rollers on the same axle, the rollers having different diameters. In so far as this resulted in concentrating the weight of the roller on a smaller area of earth, this was an improvement over the smooth roller, but the *method* of compressing the earth *from the top downward* remained unchanged, and a satisfactory compression could only be secured by long continued rolling over very thin layers of earth. Even then, soft spots were not always discovered, due to the bridging of them by the roller. In wet clay, moreover, a grooved roller acts just as a smooth roller does, and frequently picks up great rolls of clay which stick to the surface of the roller.



Traction Engine Drawing Train of Tamping Rollers.

The tamping roller can be worked in wet clay, and its "iron feet" clean themselves automatically. In fact they pull themselves free of the material, just as an animal pulls its feet out of the mud. This makes it possible to roll a clayey embankment with the rolling tamper shortly after a heavy rain, which is impossible with a grooved roller or a smooth roller of any kind. Hence the work is not delayed by rainy weather because of any inability to roll the earth.

In making foundations for roads and streets it has been the custom in the past to increase the thickness of the foundation wherever the natural earth is soft, in order to distribute the concentrated wheel loads over larger areas of subsoil. On some soils a concrete or macadam foundation only 4 ins. thick is ample to support the heaviest wheel load. On other soils an 8-in. foundation is none too thick. But there is no soil that can not be compacted to such density with the rolling tamper that it will be far denser than the most compact natural soil. To prove this, a clay soil, weighing 90 lbs. per cu. ft. in its natural state in place, was plowed up and rolled with rolling tampers until their "feet" walked on top of the compacted surface. Then a cubical block of this soil 2 ft. square and 6 ins. thick was dug up and weighed. Its weight was found to be 115 lbs. per cu. ft., as compared with 90 lbs. before rolling. By mixing some gravel with the plowed clay, and rolling, a weight of 125 lbs. per cu. ft. was easily secured.

The moral of this is clear. Instead of specifying a thickness of 6 or 8 ins. or more of concrete or macadam, an engineer should specify plowing and compacting of the subgrade to such a degree of hardness that a 3 or 4-in. layer of concrete or macadam will serve on the compacted subgrade as well as a 6 or 8-in. layer serves on the ordinary subgrade. Where the natural subgrade is sand, it is advisable to haul in some loam or clay to mix in with it by means of farm cultivators before compacting with the rolling tamper.

The rollers shown in the photograph are made by the Petrolithic Pavement Co., 232 Pacific Electric Bldg., Los Angeles, Calif.

The first electric current from the power house of the Sanitary District of Chicago, at Lockport, Ill., was transmitted to Chicago on Nov. 27. The development of the water power cost about $4,000,000.

Methods and Costs; Some Old, Some New.

Data on Street Sprinkling at Washington, D. C.—About 40 miles of streets and roads in the District of Columbia are sprinkled each day upon which weather conditions were such as to render it necessary. The District owns its own sprinklers and teams and hires the drivers. In all 19 sprinklers are used, four on the heavily traveled car-track paved streets, and 15 on macadam and dirt streets or roads. Each sprinkler is required to cover two miles of territory from 8 a. m., to 5 p. m., at least three times each day. The sprinklers are 2-horse wagons, and have a capacity of 450 gallons each. On the average, it is necessary to fill the tanks about every 3½ squares, or a distance in one direction of 1,750 ft. The dimension of the spray nozzle on the inside is 4½ ins. in diameter, and the holes through which the water flows vary from 2/32 ins. to 4/32 ins. and cover a diameter of 2½ ins. The water is supplied free of charge, and drivers are paid $1.75 per day, in addition to which it is estimated that the cost of maintaining the horses, repairs, etc., is about $1.25 per day, or a total of $3.00 for each day per wagon for each day upon which work is performed. As the average width of macadam, gravel, and dirt streets and roads is 32 ft. it will be seen that 450 gallons of water covered an area of about 6,222 sq. yds. The cost of the sprinkling for the fiscal year ending June 30, 1907, was as follows:

Drivers	$ 4,621.27
Forage, pro rata	4,863.77
Horseshoes and nails, pro rata	218.55
Incidental expenses, pro rata	419.13
Miscellaneous expenses, pro rata	830.46
Wages of extra laborers	1,289.13
Total	$12,242.31

The total number of days worked was 195.

The cost of maintaining and operating each sprinkler for the fiscal year was about $644.33. On the basis that 40 miles of street of an average width of 32 ft. were sprinkled three times each day, the cost per 1,000 sq. yds. for sprinkling would be about .028 cts. Data on the cost of street cleaning at Washington was given on p. 306 of our issue of Nov. 27, the machines used for sweeping being those manufactured by J. S. Barron, New York. For the information in this article we are indebted to the last annual report of John T. Twohey, superintendent of street cleaning department, District of Columbia, and to additional data that he has furnished us.

Data on Terra Cotta Brick Fire Proofing.—Solid bricks of porous terra cotta were used for fireproofing the floor arches and for girder and column coverings at the U. S. Government printing office, completed in 1903, at Washington, D. C. In connection with the floor arches a very heavy skewback having projecting flanges 1½ ins. thick was designed. The protecting flanges were very heavy and strong, and meet, with a small mortar joint, under the beam. The lower flanges or girders were covered with shoes of the ordinary form, meeting under the girder. They were, however, much heavier than ordinarily used, being solid and 2½ ins. thick. They were filled with mortar and squeezed on, so as to have a solid bearing, and were then wrapped all around with wire lathing and plastered with Portland cement mortar. On top of the shoes, on either side of the girder, was built a 4-in. terra cotta brick wall, the wire lathing being applied before the 4 ins. walls were built. The 4 ins. walls on the sides of the girder were carried to the top flange before the floor arches were built. The latter were then built, abutting at their ends against the upper part of the 4-in. walls, thus bracing them securely in position. The columns were covered with 4-ins. of porous terra cotta brick work built around them. The inside of the column and all space between it and the fire proofing were filled solid with Portland cement concrete. The work was done by contract, the following data being obtained by keeping records of the contractors' work:

From time required to set, it was determined that the girder shoes on the various girders were equivalent to about 8.5 bricks per linear foot. This was a little high for beams smaller than 20 ins., but it was compensated for by increased cost of changing scaffolds, centers, etc., for the smaller girders. The figures of cost do not allow for power for hoisting, furnished by the U. S., nor for contractor's general expense.

Girder Coverings of 33-in., 30-in. and 24-in. Girders:

Total labor cost:	
Per 1,000 bricks	$12.80
Per linear foot of covering	.524
Materials, exclusive of the terra cotta and wire netting:	
Per 1,000 bricks	.85
Per linear fot of covering	.162
Average day's work, per man bricks	564
Number of bricks per barrel of cement	546

Girder Coverings for Girders 20 ins. and Under:

Labor cost:	
Per 1,000 bricks	$12.80
Per linear foot of covering	.323
Materials, exclusive of terra cotta and wire netting:	
Per 1,000 bricks	3.40
Per linear foot of covering	.093
Average day's work per man bricks	564
Average number of bricks per barrel of cement	615

Column Coverings.

Labor cost:	
Per 1,000 bricks	$12.80
Per linear foot of covering	.46
Average day's work per man bricks	564
Average number of bricks per barrel of cement	545

In the one linear foot of beam covering (skewbacks) was taken as equivalent to 5.5 bricks in time and labor, data on the work being as follows:

Total labor, per 1,000 bricks	$10.64
Total labor per sq. ft. of floor	.0598
Total materials, except bricks, per 1,000 bricks	3.65
Total materials, except bricks, per sq. ft. of floor	.021
Average day's work per man bricks	892
Average number of bricks per barrel of cement	575

The above figures are based on the actual number of bricks laid plus 3 per cent for waste. The average cost of all fireproof construction, excluding ceilings, but including column and girder coverings, and including roof, was 36.4 cts. per square foot, of which 9.5 cts. was labor applied at the building. Some of the wages in force on the work were as follows per 8-hour day: Laborers, $1.50 to $2; bricklayers, $4 to $4.50.

A rather interesting piece of road work has recently been completed for a real estate company near Oakland, Cal. The road is built along the side of a steep hill and in reality consists of two separate roads. The road is 40 ft. wide and at a point where the slope of the hill is steepest there is a difference of 10 ft. in the elevation of the two curbs. The roadway has been divided in the center by the construction of a concrete retaining wall, running along the middle for a distance of about 340 ft., on the top of which posts and a double line of chains are hung as a guard. The upper half of the roadway is leveled off even with the top of this concrete wall, making a separate road 20 ft. wide. The lower half is leveled to agree with the base of the wall, and is also a separate road, also 20 ft. wide. At both ends of the concrete retaining wall the two sections run together, and the roadway is carried forward thenceforth the regular width of 40 feet. This method of treatment was employed to overcome the difficulty encountered in terracing. Flowering vines are to be planted at the base of the wall.

LETTERS TO THE EDITORS

Contract Work Payment by Warrants.

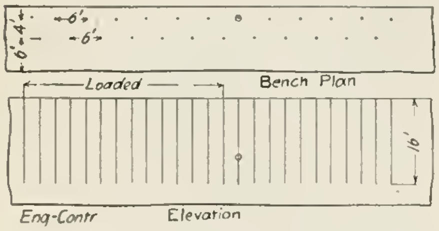
Sirs: Referring to the first article in your issue of Nov. 13, p. 273, you state that the Vrooman act is the first legislation you have heard of which provides for cities paying for work of contractors with warrants or special tax bills against the property.

The city charter of St. Louis (of 1876) provides for certain street improvement and sewer work to be paid for in this manner and millions of dollars' worth of work have been done in this manner. It seems to have worked in a very satisfactory manner. The contractors do not complain and I think that it has been very seldom that the prices have been boosted on account of payment being made in special tax bills instead of payment direct by the city.

Yours truly,
O. W. Childs.
Street Department, St. Louis, Mo.
Nov. 26, 1907.

Premature Explosion Caused by Using Broken Iron to Put Down Blast Hole.

Sirs: An accident to a man loading blast holes in a bench at a quarry of which I am in charge suggests the following remarks. The quarry is producing crushed stone for ballast. The accompanying sketch shows a plan and elevation of the bench. The man was pushing the 13-lb. 1¼x8-in. stick of 60 per cent Aetna dynamite in the hole marked when the charge exploded, fortunately with no serious injury to the man. Had the explosion discharged the other loaded holes it is probable that I would have had several men killed in the pit as well as on the bench.



Sketch Showing Plan and Elevation of Bench.

My reason for writing is that in Gillette's "Rock Excavation: Methods and Cost," a practice is advocated which I and many others have followed for years, namely to put pieces of iron in a hole that hangs the bit up by raveling. It is the only way to get the hole down, but I am forced to believe that it was the cause of the explosion that I mention. I thing that a driller when he has used iron in a hole should be required to mark the plug in that hole as a caution to the blaster. The driller in the case cited maintains that he did not use iron in the hole in which the charge exploded, but I am inclined to believe that he did. Iron was used in several adjacent holes. The dynamite was soft and the tamping pole was in one piece without a splice, so that there was no nail or iron of any sort near the hole unless it was used there in drilling. I had a similar accident in 1897 in southern Illinois in a quarry on the Illinois Central R. R.; the man was trying to force the second stick of 60 per cent Aetna past an obstruction in the hole when it exploded. I believe the possible danger of iron used in drilling is worth cautioning blasters about.

Yours truly,
W. R. More.

Surveyor W. Va., Oct. 30, 1907.

(The suggestion of our correspondent about marking the plug to show that broken bits of iron have been used in putting down the hole is one that should be followed.—Editor.)

Force Account and Contract Work.

Sirs:

I have read with considerable interest the recent discussion relative to the cost of reinforced concrete pipe on the Salt River Project in Arizona, in the issues of Engineering-Contracting of Sept. 11, Sept. 18 and Nov. 6. Whether the cost of that particular work was excessive or whether it was low does not, I believe, lead us to the final solution of the problem of whether or not it is advisable for the Government to do its reclamation work or, indeed, any other similar work by force account.

The main question of Government work by Force Account as against work by Contract is now being answered through experience. Having had charge of both kinds for the Government since the inauguration of work by the Reclamation Service and very recently having been contractor-engineer for a contracting firm on Government work, I have formed an opinion of what the ultimate solution will be. In passing, however, I may say that I think that the prices cited in your editorial of work done in France and in the East form at best but an imperfect basis of comparison. One who has not worked, during the last four years, at any point west of, say, 100th meridian, can scarcely appreciate the difference in the quality of the labor in the East and in the West.

In the East, and to a greater degree in France, common labor is more or less of a trade or profession. There men are better contented with their social and business position, they take a certain pride in doing good work and in long service in one locality and on one job. The character of labor which the Chief Engineer mentions as having been used on the work in Arizona would not, I imagine, be tolerated on works in the East.

Some time since in discussing this question with one of my assistants in charge of force account work he maintained that he was doing work at less cost than the contractor, who was working at the same time in the same locality. On being asked if he could not do work for still less if the Government restrictions or so-called "red tape" were removed, he replied that he could. In other words, he thought that if he were in charge, for the contractor, the work could have been done more cheaply.

It appears, therefore, that the contractor mentioned needed better men in charge of his work. Among contractors in the West generally, I believe that not enough expert assistance is employed. If they employed the same class of men that the Government does to superintend their work they could probably materially reduce cost. In Government work by force account I found the impression prevalent at first that one need not work as faithfully or as hard for the Government as for a contractor. Government force account work in general was considered a snap. This impression has largely been corrected and this phase of the problem need no longer be considered.

Another point, one mentioned by you, is the severe requirements contained in all Government specifications. It is a fact that in a Government contract the requirements are practically inflexible, and there are sufficient reasons for this. A Government engineer cannot go to his employer as does an engineer employed on a railroad, and, laying the matter before him, receive authority to alter the specifications when of mutual advantage or when they have been found to be unnecessarily harsh, or to be unjust. A contractor undertaking Government work must therefore make his bid with the knowledge that the specifications will be enforced to the letter.

Again, specifications must be so drawn that a tricky contractor, for we must admit that there are such, can be made to do his work properly; and unless the plans have been well worked out and are definite and final and few uncertainties exist, this is extremely difficult. Moreover, it is not always practicable to select from among several bidders someone other than the one having the lowest bid. To turn down a bid on public work one must have a well defined and valid reason and one that can, if necessary, be substantiated. This being the case we must make provision against contractors who are mediocre as to ability or who are almost but perhaps not quite in the "unreliable" class.

On certain kinds of work, as in straight excavation, specifications can be drawn which will need no change, the requirements can be foreseen with considerable certainty and made as liberal as possible, while on other kinds of work, such as the building of concrete structures or canals this is practically impossible. I recall one contract embracing over 400 structures of various types, sizes, and widely scattered. In this case it was finally decided to build the greater number (they being small) by force account and the larger and more important ones by contract.

In the execution of the work by force account the plans were changed to suit the varying local conditions at each point, e. g.

where it was deemed unnecessary to screen the gravel this was not done; material which it would not have been advisable, possibly, to use in important structures, was here used at a great saving in cost. Changes in materials, quantities, plans and even in location did not involve the engineers in a mass of claims and counter claims for extras, delays, etc.

In the meantime the contractor on the large structures was pushing his work to the best of his ability under rigid specifications and inspection and at necessarily greater cost. He was denied the privilege of using materials which were being used on the force account work, was compelled to "finish" his work in a different manner and at times even the method of doing the work was dictated by the inspector.

When a doubt exists in the mind of an inspector on contract work he is almost sure to choose the more expensive method. I have even heard an inspector say that as the contractor was getting big prices and making money "it did not hurt his conscience a bit" to make such a ruling. On the other hand, on force account work, the foreman, for there is no inspector here, will invariably do the work in the quickest and cheapest manner possible if, in his opinion, it is "just as good." Some of the railroads have solved the problem to a great extent. With them such work as can readily be let, especially work involving the employment of a large number of teams, is done by contractors; but other work, such as bridges, culverts and structures, generally are done by their own crews.

In the execution of work by force account I may add that one danger exists which should be guarded against. Foremen who know that a strict account is being kept of cost naturally wish to make a record, and not understanding thoroughly the reasons for certain requirements, they are apt to alter or slight the work at vital points. This tendency in force account work has its counterpart on contract work where the contractor or his foreman wishes to increase as much as possible the net profit. Rigid inspection is necessary and is always provided on contract work, in my opinion it is fully as necessary on force account work. It is not strange, therefore, that the high bids quoted by Mr. Davis were the lowest obtainable from contractors.

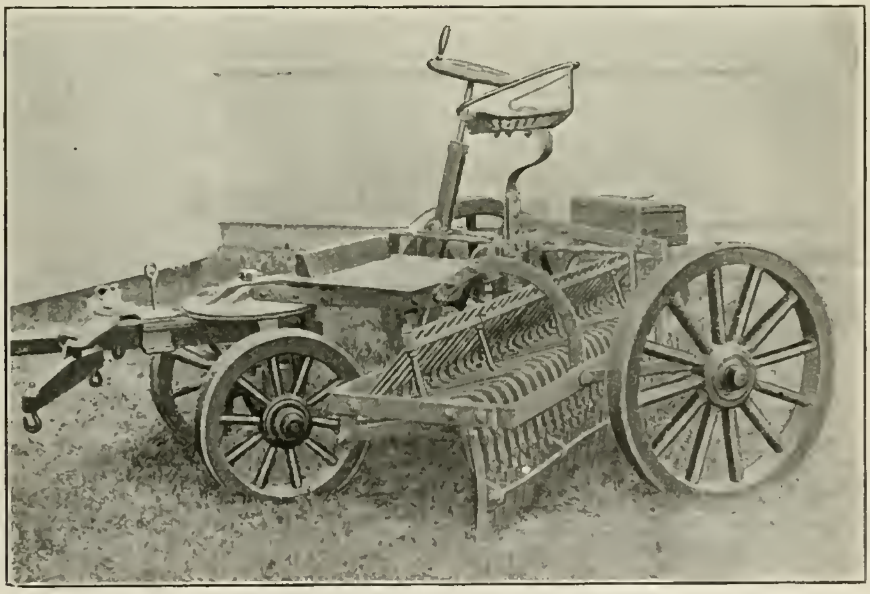
I believe that there can be no doubt but that contractors can do work more cheaply than the Government if they are allowed the same latitude to take advantage of local conditions. That is, if they are not hampered by Government regulations, especially those of the Treasury Department, affecting the hiring of men, the civil service, the purchase of supplies and materials, advertising and the vast amount of time consumed and labor necessary in paying a single bill. (The smaller and the simpler the more difficult this is, apparently.)

My opinion is that, ultimately, practically all excavation work, the great dams, and other work which can be definitely determined on beforehand, will be done by contract; that the consulting and supervising engineers will then make the requirements as liberal as possible and strive in writing the specifications to give the contractor a show and not place him in a position where he is almost entirely at the mercy of the younger engineers and inspectors; and that smaller structures and great tunnels where so much uncertainty necessarily exists will be done by force account and that the Government will have an efficient force on hand to send from place to place to do this work. It is impractical in my opinion to let contracts on long tunnels. A contractor taking such work must figure on the worst possible conditions to be safe and as the Government desires neither to break a contractor nor to pay an unreasonable profit, it appears that in such cases work by force account is necessary.

Yours very truly,
JOHN E. FIELD,
Consulting Engineer, Denver, Colo.
Nov. 25, 1907.

A Machine for Cleaning Mud from Macadam Roads and Rough Pavements Which Are More or Less Irregular in Surface.

We illustrate herewith a scraper for cleaning roads and streets and one that does thorough cleaning regardless of whether the surface of the pavement is irregular or smooth.


Scraper for Cleaning Roads and Streets.

As will be noticed, the machine has numerous teeth like the familiar farmer's hay rake: but each tooth, at the point, is shaped like a small hoe. Each of these thirty-three hoes is on a separate spring so that it goes down into any hollow or indentation in the pavement. The scraper thus drags along over the pavement, cleaning a width of 5½ ft. at each passage. The pressure on the blades or teeth can be regulated by the driver. In this manner the road or pavement is scraped clean, no matter how rough or full of holes it may be.

Naturally this can only be done in the mud, so if the pavement is dry it must be well soaked with water to use this machine. The ordinary street sweeper cleans dry pavements, but cannot be used successfully for mud. This machine has not been designed to take the place of a sweeper, but to supplement its use, in such weather that it is not possible to clean streets with a sweeper. The exception to this is with macadam pavement. Few machines have been designed to clean macadam, but this scraper will do it without injury to the pavement. A thin coating of dust, ¼-in. thick, it is stated, can be taken off the macadam, if the road is sprinkled. In wet weather mud can be taken from a macadam road at all times by this scraper.

The machine scrapes up the mud from the pavement in thin rolls, which accumulate into large rolls until the scrapings are dropped in a row by the machine. It is said that about 6,000 to 8,000 sq. yds. of pavement can be cleaned by this machine in an hour. It has been tested on all kinds of pavements, having been used in more than a dozen cities for several years; and we are informed that it not only has cleaned all kinds of pavements but without injury to them. We are told that in Brooklyn, N. Y., cobble paving has been kept clean during the winter with these machines, when all other methods failed.

Another valuable use for this scraper is the cleaning of slush and snow from streets. It will not scrape up ice or frozen slush or snow, but freshly fallen snow or slush it cleans up as it does mud. The weight of the machine is 2,000 lbs.

This pavement scraper is sold by the J. H. Strain Co., 12 Elm St., New York.

Grouting a Siphon Tunnel.

A 54 in. pipe is used to carry a gas supply under a river crossing. The pipe was laid in 8 ft. lengths in a tunnel driven beneath the bed of the river and lined with timber lagging having an outer diameter of 7 ft. This lagging consisted of circular segments 6 in. wide, sawed from 2 in. plank. Eight of these segments formed a ring. Between the pipe and the lagging there was a space varying from nothing, where the lagging was cut out to improve the alinement, to 6 in. at a point diametrically opposite. This space was filled with grout, the following method being employed: The grout was mixed in a trough at the top of the shaft and was discharged into a pressure trough, from whence it was carried down the shaft in 1½ in. pipes. A pipe carrying a jet of steam, acting on the principle of an injector, was connected to the grout pipe at the bottom of the shaft and steam forced in with the grout. In laying the 54 in. pipes, bulkheads had been built between the pipe and lagging every 25 ft. or so. A ⅜ in. hole was tapped in the top of the pipe for each length, and into these holes the grouting pipes were successively introduced, the progress of the grouting being watched through the holes in the succeeding lengths, and the pipes plugged when the grout began to appear. As the reach from the steam jet to the introducing hole became greater and the time of changing forward became longer, the injector became plugged with cement and was finally abandoned, the pressure due to the height of the height of the mixing trough being used and the pipe washed out with clean water after each run. When the distance became too great to get the desired pressure by this method, the grout was mixed in the tunnel and injected by means of a force pump. The best results, however, were obtained when the steam jet was used, the cement seeming to have swollen in setting.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write direct to the advertisers and state that you saw the catalog mentioned in *Engineering-Contracting*. If you are in the market for tools, machinery or supplies tell us and we will notify promptly the leading manufacturers.

No. 0474. **Mining Machinery.**—Traylor Engineering Co., 2 Rector St., New York N. Y.

The bulk of this 24-page pamphlet is devoted to a description of the construction and operation of the special concentrating table made by the company named. Illustrations are given of the assembled table and of its several parts, and then complete instructions for the installation of the table. The other machinery shown comprises crushers, grinding rolls, jigs, converters and furnaces for copper matte, silver-lead, etc.

No. 0475. **Cast Pipe.**—Central Foundry Co., 116 Nassau St., New York, N. Y.

This is a 65-page catalog of cast pipe and pipe fittings for water, gas and steam systems. The strength, size, capacity, weight and price of the several kinds of pipes and fittings are given.

No. 0476. **Hydraulic Pumps.**—The Watson-Stillman Co., New York, N. Y.

This 140-page book illustrates and describes the various sizes and patterns of the large lines of hydraulic pumps manufactured by the firm named. The pumps listed vary in size and character from small hand operated machines to high power, steam-operated machines for the highest pressures. Tables of prices, lists of parts, etc., are given.

No. 0477. **Flexible Roller Bearings.**—Hyatt Roller Bearing Co., Harrison, N. J.

This pamphlet contains 80 pages. The article that it describes is so well known almost as to need no description, but there is a discussion of the problem of frictionless bearings which merits being read by every one at all interested in such devices. Besides the descriptive matter there are complete tables of sizes, prices and other common catalog data.

No. 0478. **Builders Specialties.**—Chicago Builders Specialties Co., Chicago, Ill.

This 40-page pamphlet lists twisted bar and expanded metal reinforcement for concrete; concrete mixers; metal laths, furring, staples and tie wire for lathers and plasterers; joist hangers, anchors, dogs, straps, etc., for carpenters; metal lockers and miscellaneous articles. The power mixer described known as the United is a tilting mixer of novel and interesting design.

No. 0479. **Crane and Dredge Chains.**—Woodhouse Chain Works, Trenton, N. J.

This little 14-page pamphlet describes interestingly the construction and quality of the special dredging chains made by the firm named. Particular mention is made of the firms special dredge chain made of special iron. There are some interesting instructions about th ecare of chains.

No. 0480. **Gas Furnaces.**—American Gas Furnace Co., New York, N. Y.

This is a book of over 200 pages describing, illustrating and cataloguing gas generators, pressure blowers, gas blast furnaces, heating machines and blow pipes and burners. Each size and type of each kind of apparatus is described in all its essential features, and its capacity and the kind of work for which it is specially fitted are stated. The catalog is a valuable one.

No. 0481. **Gas Engines.**—Lazier Gas Engine Co., Buffalo, N. Y.

This is an excellent descriptive pamphlet. Detail drawings are shown of all parts of the engine and each part is fully described. The pamphlet is worth securing.

No. 0482. **Box Car Loader.**—The Ottumwa Box Car Loader Co., Ottumwa, Iowa.

An attractively gotten up catalog of 80 pages describes and illustrates the economy and uses of this box car loader, for loading coal into box cars. Coal mines are frequently hampered in their operations by not being able to get coal cars for shipping their product. Box cars can nearly always be obtained. With this car loader the latter can be loaded as quickly as the hopper cars. We see no reason why crushed stone could not be loaded into box cars with this machine, thus aiding in the quick delivery of stone from the quarries to large cities.

No. 0483. **Electrification of West Shore R. R.** General Electric Co., Schenectady, N. Y.

The electrification of the West Shore R. R. between Utica and Syracuse has been closely watched. Special attention has been attracted to it on account of its 60,000-volt transmission line, the adoption of an inverted, protected third rail, and the hydro-electric development from which power is supplied. In this bultelin the installation is very completely described. The bulletin is illustrated with views of the trains, interior of the cars, transmission lines, exterior and interior of sub-stations, plans of the buildings and wiring diagrams, and details of the track construction. Not the least interesting feature of the pamphlet is a comparison of two train sheets, one showing the operation before electrification, and the other after, where the increase in traffic with the same track capacity is very strikingly shown. The bulletin cannot fail to be of interest to all steam railroad engineers, as well as those actively engaged in electric traction.

Personals.

James H. De Graff, a well known contractor, died suddenly Nov. 27 at Buffalo, N. Y., aged 73 years.

Mr. Robert Kelly of Syracuse, N. Y., has accepted a position in the Engineering Department of the New York Central with headquarters in New York.

A. J. McLaughlin, Superintendent of Construction on the new Wisconsin Central Ry. tunnel at Duluth, Minn., died last week in the hospital in that city from the effects of an overdose of morphine.

Mr. Edwin E. Sparks, Professor of American History in the University of Chicago, has been elected President of Pennsylvania State College at Bellefonte, Pa. He will begin his new duties in June, 1908.

Mr. Frank Gougar has been elected president of the Tacoma Dredging Co., of Tacoma, Wash. The other officers elected were as follows: A. U. Mills, Vice-President; E. M. More, Secretary and Treasurer, and A. W. Tweeden, General Manager.

Messrs. E. L. Chauvin, J. E. Millikin and W. C. McGrory have opened offices in the Link Bldg., Orange, Tex., and will engage in a general contracting business, making a specialty of the construction of brick and stone buildings, sidewalks and sewerage.

Mr. Matthew Woods of 320 Bear St., Syracuse, N. Y., has been engaged by the Stewart-Kerbaugh-Shanley Co., of New York City, as superintendent of the construction of a number of state roads, for which the above company has recently been awarded contracts.

H. B. Camp, a well known manufacturer of sewer pipe and other clay products, died Nov. 21 at Akron, O. Mr. Camp built the Ashland & Wooster R. R., and has been engaged in building a line from Cleveland to Independence, with Akron as the ultimate terminus.

Mr. George J. Roberts, Chief Engineer of the United Gas Improvement Co., of Philadelphia, Pa., has been appointed First Vice-President of the Public Service Corporation of New Jersey, and will have charge of the operation of all its gas, electric and railway properties.

Mr. Foster Crowell, Consulting Civil Engineer, of 18 Broadway, New York, has been appointed Commissioner of Street Cleaning of New York City, to succeed Dr. Walter Bensel, who has resigned to resume his former position as Sanitary Superintendent in the Department of Health.

Mr. Stephen E. Kieffer, M. Am. Soc. C. E., has opened offices in the First National Bank Bldg., Berkeley, Cal., where he will engage in a general practice of civil and hydraulic engineer. Special attention will be paid to municipal engineering, water supply, power development, irrigation and land reclamation and development.

Capt. George M. Hoffman, Corps of Engineers, U. S. A., who has been in command of the Third District, Mississippi River Improvement, with headquarters at Vicksburg, Miss., for some years, is to be relieved and transferred to Panama for duty on the canal. He will be succeeded at Vicksburg by Capt. Clarke Smith, who is now stationed in Cuba.

Mr. John E. Field of the firm of Field, Fellows & Hinderlider, of Denver, Colo., has been appointed by Mayor Speer, of that city, as Consulting Engineer for the city in the matter of the appraisal of the works of the Denver Union Water Supply, which the city contemplates purchasing. The appraisal board is composed of Frederick P. Stearns, Minard L. Holman, John R. Freeman, C. L. Harrison and Allan Hazen.

Mr. Robert Coltman, 3rd, formerly assistant to Mr. Halbert P. Gillette, M. Am. Soc. C. E., in the work of appraising the railways of the state of Washington, and more recently located at Tientsin, China, has been appointed Resident Engineer on the construction of a highway bridge 760 ft. long over the Yellow River at Lanchoufu in Kansu Province, China. Mr. W. R. Tuckey, Assoc. M. Inst. C. E., is Consulting Engineer for the bridge and Telge & Schroeter, Tientsin, China, are the contractors.

Abel G. Goldthwait, M. Am. Soc. M. E., died at Troy, N. Y., during the night of November 16. He was engaged at his office until about six o'clock that evening and retired in apparent good health, dying a few hours later of neuralgia of the heart. Mr. Goldthwait was born in Sandgate, Vt., 70 years ago, and when a young man went to Troy, N. Y., and secured a position as pattern maker and draftsman with the Tolhurst Machine Works of that city. He was especially proficient as a designer of machinery. Practically his entire life was spent in the employ of the Tolhurst Company and for many years past he has been vice-president of the company.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED

Bridges.

Dec. 4. Newport, Ind. .... Nov. 20
Dec. 4. Muncie, Ind. .... Nov. 20
Dec. 4. Fargo, N. Dak. .... Nov. 27
Dec. 5. River Falls, Wis. .... Nov. 27
Dec. 6. La Crosse, Wis. .... Dec. 4
Dec. 9. New York, N. Y. .... Nov. 27
Dec. 9. Etna, Pa. .... Dec. 4
Dec. 9. Girard, Kan. .... Dec. 4
Dec. 9. Los Angeles, Cal. .... Dec. 4
Dec. 10. Jackson, Minn. .... Nov. 20
Dec. 10. Troy, O. .... Dec. 4
Dec. 10. Girard, Kan. .... Dec. 4
Dec. 11. Houston, Tex. .... Nov. 27
Dec. 14. Norwood, O. .... Nov. 27
Dec. 16. Altadena, Cal .... Dec. 4
Dec. 18. Cleveland, O. .... Nov. 27
Dec. 18. Granville, Ind. .... Dec. 4
Jan. 2. New Orleans, La. .... Dec. 4
Jan. 7. Castle Haynes, N. C. .... Nov. 20
Jan. 7. Salem, S. Dak. .... Nov. 27
Feb. 13. St. Charles, Mo. .... Oct. 30

Buildings.

Dec. 5. Waldoboro, Me. .... Oct. 30
Dec. 5. Fort Thomas, Ky. .... Dec. 4
Dec. 5. Ellis Island, N. Y. H. .... Dec. 4
Dec. 6. Boston, Mass. .... Dec. 4
Dec. 6. Pittsburg, Pa. .... Dec. 4
Dec. 7. Remsen, N. Y. .... Nov. 13
Dec. 9. Wernersville, Pa. .... Nov. 6
Dec. 9. Los Angeles, Cal. .... Nov. 20
Dec. 9. Pulaski, Tenn. .... Nov. 20
Dec. 9. Chicago, Ill. .... Nov. 20
Dec. 9. Cincinnati, O. .... Nov. 27
Dec. 9. Philadelphia, Pa. .... Dec. 4
Dec. 9. Carbondale, Ill. .... Dec. 4
Dec. 10. Canton, S. Dak. .... Nov. 13
Dec. 10. Alpine, Tex. .... Nov. 13
Dec. 10. Mobile, Ala. .... Nov. 13
Dec. 10. Jacksonville, Fla. .... Nov. 13
Dec. 10. Chattanooga, Tenn. .... Nov. 27
Dec. 10. Fort Revere, Mass. .... Dec. 4
Dec. 11. Ladysmith, Ont. .... Dec. 4
Dec. 12. Whipple Barracks, Ariz. .... Nov. 20
Dec. 12. Chicago, Ill. .... Dec. 4
Dec. 12. Chicago, Ill. .... Dec. 4
Dec. 12. Bayonne, N. J. .... Dec. 4
Dec. 13. Chicago, Ill. .... Dec. 4
Dec. 14. New Orleans, La. .... Dec. 4
Dec. 16. Pulaski, Tenn. .... Nov. 27
Dec. 16. Painesville, O. .... Dec. 4
Dec. 17. Detroit, Mich. .... Nov. 6
Dec. 17. Pawnee, Okla. .... Nov. 13
Dec. 17. Hallock, Minn. .... Dec. 4
Dec. 19. Ocala, Fla. .... Nov. 13
Dec. 19. Dayton, O. .... Nov. 27
Dec. 21. Fort Worth, Tex. .... Nov. 27
Dec. 21. Madison, Kan. .... Dec. 4
Dec. 21. Washington, D. C.,
Dec. 23. Ann Arbor, Mich. .... Nov. 6
Dec. 23. Fort Des Moines, Ia. .... Nov. 27
Dec. 23. Soldiers Home, Cal. .... Dec. 4
Dec. 26. Richmond, Va. .... Dec. 4
Dec. 27. Tulalip, Wash. .... Nov. 27
Dec. 27. Tulalip, Wash. .... Nov. 27
Dec. 27. San Francisco, Cal. .... Dec. 4
Dec. 30. Lancaster, Pa. .... Nov. 13
Jan. 2. Flint, Mich. .... Nov. 13
Jan. 2. South Bend, Ind. .... Nov. 20
Jan. 3. Albuquerque, N. Mex. .... Nov. 20
Jan. 6. Wichita, Kan. .... Nov. 27
Jan. 6. Cincinnati, O. .... Dec. 4
Jan. 8. Fort Spokane, Wash. .... Nov. 27
Jan. 10. Cheyenne Agency, S. Dak. .... Nov. 27
Jan. 15. Winnibago, Neb. .... Dec. 4
Jan. 18. Pine Ridge, S. Dak. .... Dec. 4

Roads and Streets.

Dec. 4. Logansport, Ind. .... Nov. 20
Dec. 4. Hartford City, Ind. .... Nov. 27
Dec. 4. Des Moines, Ia. .... Nov. 27
Dec. 4. Brooklyn, N. Y. .... Nov. 27
Dec. 4. Baltimore, Md. .... Nov. 27
Dec. 4. Dayton, O. .... Dec. 4
Dec. 5. Danville, Ind. .... Nov. 20
Dec. 5. Toledo, O. .... Nov. 27
Dec. 5. Memphis, Tenn. .... Dec. 4
Dec. 6. Indianapolis, Ind. .... Dec. 4
Dec. 6. Salt Lake City, Utah .... Oct. 23
Dec. 6. Buffalo, N. Y. .... Dec. 4
Dec. 7. Peru, Ind. .... Nov. 13
Dec. 7. Denver, Colo. .... Dec. 4
Dec. 9. Camden, N. J. .... Dec. 4
Dec. 10. Lebanon, Ind. .... Nov. 13
Dec. 10. Kansas City, Mo. .... Dec. 4
Dec. 10. Salem, N. J. .... Dec. 4
Dec. 10. St. Louis, Mo. .... Dec. 4
Dec. 11. Fort H. G. Wright, N. Y. .... Nov. 27
Dec. 11. Harrisburg, Pa. .... Nov. 27
Dec. 11. Columbus, O. .... Dec. 4
Dec. 11. Madisonville, O. .... Dec. 4
Dec. 11. Brooklyn, N. Y. .... Dec. 4
Dec. 12. Flemington, N. J. .... Nov. 20
Dec. 12. Anderson, Ind. .... Nov. 27
Dec. 13. Monticello, Ind. .... Oct. 30
Dec. 13. Harrisburg, Pa. .... Nov. 27
Dec. 14. Lebanon, Ind. .... Nov. 13
Dec. 16. Steubenville, O. .... Nov. 27
Dec. 16. Harrisburg, Pa. .... Dec. 4
Dec. 16. Erie, Pa. .... Dec. 4
Dec. 17. Providence, La. .... Nov. 27
Dec. 20. Washington, Pa. .... Nov. 27
Jan. 3. Salt Lake City, Utah .... Dec. 4
Feb. 4. Billings, Mont. .... Nov. 27

Sewers.

Dec. 4. Des Moines, Ia. .... Nov. 20
Dec. 4. Dayton, O. .... Dec. 4
Dec. 5. McKeesport, Pa. .... Nov. 27
Dec. 5. St. Paul, Minn. .... Nov. 27
Dec. 6. Salt Lake City, Utah .... Nov. 6
Dec. 6. Flint, Mich. .... Nov. 27
Dec. 6. Indianapolis, Ind. .... Dec. 4
Dec. 7. Marcy, N. Y. .... Nov. 20
Dec. 9. Orrville, O. .... Nov. 27
Dec. 9. Indianapolis, Ind. .... Dec. 4
Dec. 9. Toledo, O. .... Dec. 4
Dec. 9. Steubenville, O. .... Dec. 4
Dec. 9. Lorain, O. .... Dec. 4
Dec. 9. Reno, Nev. .... Dec. 4
Dec. 11. Brooklyn, N. Y. .... Dec. 4
Dec. 12. St. Paul, Minn. .... Dec. 4
Dec. 17. Louisville, Ky. .... Nov. 27
Dec. 18. Springfield, O. .... Dec. 4
Dec. 28. Evansville, Ind. .... Dec. 4

Water Supply.

Dec. 4. Dayton, O. .... Dec. 4
Dec. 7. Atlantic, Ia. .... Dec 4
Dec. 9. Bay Minette, Ala. .... Nov. 27
Dec. 12. Cambridge Springs, Pa. .... Nov. 20
Dec. 17. Camden, N. J. .... Oct. 16
Dec. 17. McComb, Miss. .... Deo 4
Dec. 19. Fort Dade, Fla. .... Nov. 27
Jan. 1. Norway, Me. .... Nov. 27
Jan. 8. Tucson, Ariz. .... Nov. 27

Miscellaneous.

Dec. 4. Altoona, Pa.,
Garbage Disposal, Nov. 6
Dec. 4. Danville, Ill.,
Telephone System, Nov. 20
Dec. 5. Edgewood, Pa.,
Garbage Disposal, Nov. 27
Dec. 9. Erie, Pa.,
Street Lighting, Nov. 27
Dec. 9. Fort Hancock, N. J.,
Wharf Repairs, Nov. 27
Dec. 10. New York, N. Y.,
Street Lighting, Dec. 4
Dec. 11. Montgomery, Ala.,
Bulkhead, Nov. 27
Dec. 11. New York, N. Y.,
Water Curtains, Nov. 27
Dec. 12. New York, N. Y.,
Trimming Scows, Etc., Dec. 4
Dec. 17. Cincinnati, O.,
Flatboat, Nov. 27
Dec. 17. Philadelphia, Pa.,
Grade Crossing Work, Nov. 27
Dec. 17. Fort Hancock, N. J.,
Garbage Crematory, Nov. 27
Dec. 18. Madison, Wis.,
Concrete Work, Wrecking, Nov. 13
Dec. 20. Portland, Ore.,
Steamboat, Nov. 20
Dec. 20. Lafayette, Ind.,
Electric Lighting, Nov. 27
Dec. 21. Chinook, Mont.,
Electric Light Works, Nov. 20
Dec. 21. Washington, D. C.,
Metal Work, Dec. 4
Dec. 23. Portland, Ore.,
Hydraulic Dredge, Nov. 27
Dec. 27. Boston, Mass.,
Wreck Removal, Dec. 4
Dec. 27. Paducah, Ky.,
Tenders, Dec. 4
Jan. 14. Portland, Ore.,
Light Station, Nov. 27
Jan. 14. Columbus, O.,
Garbage Works, Dec. 4
May 1. Buenos Aires, Argentina,
Subways, Nov. 20

Excavation, Earth and Rock.

– McDougall Chutes, Ont.,
Railroad Work, Dec. 4
Dec. 6. Canton, N. Y.,
Ditch Work, Nov. 13
Dec. 7. Muscatine, Ia.
Ditch Work, Dec. 4
Dec. 10. Sac City, Ia.
Ditch Work, Dec. 4
Dec. 11. Emmetsburg, Ia.,
Ditch Work, Nov. 20
Dec. 11. Fort H. G. Wright, N. Y.,
Grading, Filling, Etc., Nov. 27
Dec. 11. Brooklyn, N. Y.,
Grading Lot, Dec. 4
Dec. 14. Boston, Mass.,
Dredging, Nov. 27
Dec. 14. Webster City, Ia.
Drainage Ditches, Dec. 4
Dec. 16. New Orleans, La.,
Levee Work, Dec. 4
Dec. 20. Mount Vernon, Ind.,
Drainage Work, Dec. 4

Materials, Machines, Supplies, Tools, Etc.

Dec. 4. Minerva, O.,
Boiler, Nov. 20
Dec. 5. New York, N. Y.,
Brick, Nov. 27
Dec. 6. Washington, D. C.,
Pumps, Blocks, Rope, Etc., Nov. 13
Dec. 6. Brooklyn, N. Y.,
Crossheads, Nov. 27
Dec. 6. Washington, D. C.,
Telephone Materials, Nov. 27
Dec. 7. Chicago, Ill.,
Water Pipe, Nov. 27
Dec. 10. North Tonawanda, N. Y.,
Fire Hose, Nov. 27
Dec. 10. Washington, D. C.,
Radiators, Nov. 27
Dec. 10. Annapolis, Md.,
Pipe Fittings, Etc., Dec. 4
Dec. 11. Washington, D. C.,
Sheet Copper, Nov. 27
Dec. 13. Washington, D. C.,
Lumber, Angles, Etc., Nov. 20
Dec. 13. Chicago, Ill.,
Lubricating Oil, Dec. 4
Dec. 13. Chicago, Ill.,
Ferrules, Dec 4
Dec. 13. Chcago, Ill.,
Gate Valves, Dec. 4
Dec. 14. Nashville, Tenn.,
Lumber, Nov. 20
Dec. 16. Tompkinsville, N. Y.,
Lanterns, Nov. 20
Dec. 17. Washington, D. C.,
Milling Machines, Etc., Dec. 4
Dec. 20. Ashville, O.,
Arc Lamps, Wire, Dec. 4
Dec. 21. Washington, D. C.,
Dump Barges, Nov. 27
Dec. 23. Washington, D. C.,
Electrical Materials, Dec. 4
Dec. 27. Washington, D. C.,
Pipe, Chain, Rope, Etc., Dec. 4
Jan. 15. Manila, P. I.,
Pumps and Motors, Oct. 30
Jan. 15. Winnipeg, Man.,
Water Pipe, Dec. 4

BIDS ASKED

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Altadena, Cal.—Until 2 p. m., Dec. 16, by C. G. Keyes, County Clerk, Los Angeles, Cal., for labor and materials necessary for the construction of two concrete culverts across Mariposa Ave., Altadena, in the Pasadena Road District.

Los Angeles, Cal.—Until 2 p. m., Dec. 9, by C. G. Keyes, County Clerk, for labor and materials necessary for the construction of a 12-ft. reinforced concrete culvert on Monterey Pass Road, near the west line of Section 32, T. 1 S., R. 12 W., in the Alhambra Road District.

Granville, Ind.—Until Dec. 18, by County Auditor, Lafayette, Ind., for constructing bridge near this place.

Girard, Kan.—Until noon, Dec. 9, by Fred A. Gerren, County Clerk, for construction of stone superstructures for the following county bridges: Vehlow bridge, in Walnut Township; Dunlop bridge, in Baker Township; Devlin bridge, in Washington Township. Also, one stone arch bridge, consisting of two 10-ft. arches, in Sherman Township.

Girard, Kan.—Until noon, Dec. 10, by Fred A. Gerren, County Clerk, for the material and erection of iron superstructure for four I-beam and one 70-ft. truss bridges.

New Orleans, La.—Until 1 p. m., Jan. 2, by Charles R. Kennedy, City Comptroller, for erection of bascule trunnion bridge over Bayou St. John at Esplanade Ave. Plans, etc., with City Engineer.

Troy, O.—Until 1 p. m., Dec. 10, by County Commissioners, for building the south abutments and facing the north abutments with concrete on the bridge over Ludlow Creek on the Range Road in Union Township; for furnishing and placing steel joints and laying plank floor on the same bridge; for furnishing and placing steel joists and laying plank floor on a bridge over Seeker Ditch in Union Township, cleaning same and painting.

Etna (P. O. Allegheny), Pa.—Until 5 p. m., Dec. 9, by A. R. Dunbar, Borough Clerk, 23 Locust St., for erecting two bridges, one steel girder bridge with the necessary abutments over Pine Creek on Grant Ave., also a bridge over Little Pine Creek on Dewey St. Proposals to be submitted on three different plans: First, a steel girder bridge with necessary abutment; second, reinforced concrete arch bridge; third, a masonry ribbed arch bridge according to plans and specifications on file in the office of the Borough Clerk; also plans, etc., can be seen at the office of the Borough Engineer, 200 Lewis Bldg., Pittsburg, Pa.

La Crosse, Wis.—Until Dec. 6, by the County Clerk, for constructing steel bridge over Black River and for laying new girders and floor for the McGillivray bridge.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

San Francisco, Cal.—Until noon, Dec. 27, by Light-House Engineer, San Francisco, Cal., for constructing two single dwellings at Humboldt Bay fog signal station (North Spit), Cal.

Soldiers Home, Cal.—Until noon, Dec. 23. by T. J. Cochrane, Treasurer, Pacific Branch, N. H. D. V. S., Soldiers Home, Los Angeles County, Cal., for construction of cold storage rooms in Hospital.

Washington, D. C.—Until 3 p. m., Jan. 7, by James Knox Taylor, Supervising Architect, Washington, for construction (including plumbing, heating apparatus, electric wiring and conduits) or an extension and remodeling of the hygienic laboratory of the U. S. Marine Hospital Service, at Washington.

Carbondale, Ill.—Until 10 a. m., Dec. 9, by Hugh Lauder, Secretary, Trustees of the Southern Illinois State Normal University, for the erection of a model school building.

Chicago, Ill.—Until 11 a. m., Dec. 12, by Department Public Works, 322 City Hall, for constructing bath house at 12th and Union Sts.

Chicago, Ill.—Until 11 a. m., Dec. 12, by Department Public Works, 322 City Hall, for reconstruction of Carter H. Harrison bathhouse, at 192 Mather St.

Chicago, Ill.—Until Dec. 13, by Business Manager Board of Education, Tribune Bldg., for constructing addition to Jackson school.

Madison, Kan.—Until Dec. 21, by Dr. C. L. Katz, for building Catholic church to cost about $3,000.

Fort Thomas, Ky.—Until 10 a. m., Dec. 5, by Capt. J. C. Castner, Constructing Q. M., for the construction of a brick stable and a frame wagon shed at Fort Thomas.

New Orleans, La.—Until 11 a. m., Dec. 14, by the Bureau of Yards and Docks, Navy Department, Washington, for furnishing a dispensary building and accessories for the naval station, New Orleans, La.

Boston, Mass.—Until noon, Dec. 6, by George H. M. Rowe, Superintendent, for plumbing in relief station of Boston City Hospital and proposed extension. Kendall, Taylor & Co., Architects, 93 Federal St.

Fort Revere (P. O. Hull), Mass.—Until Dec. 10, by Capt. C. O. Zollars, Constructing Q. M., for furnishing and installing electric light fixtures in hospital at this post.

Hallock, Minn.—Until Dec. 27, by N. P. Lundgren, Clerk Board of Education, for construction of 2-story brick and concrete school building.

Winnebago, Neb.—Until 2 p. m., Jan. 15, by Commissioner of Indian Affairs, Washington, D. C., for constructing employes' mess hall at Winnebago School. Further information may be obtained from Oscar M. Waddell, Superintendent, Winnebago.

Bayonne, N. J.—Until 8:30 p. m., Dec. 12, by J. F. Desmond, Secretary Board of Education, Avenue C and 27th St., for labor and material for erection of public school No. 10 between W. 10 and W. 11 St. Plans, etc., also at office of S. Edson Gage and Donald G. Anderson, 3 Union Sq., New York City.

Ellis Island, N. Y. H.—Until 2:30 p. m., Dec. 5, by Robert Watchorn, Commissioner of Immigration, Ellis Island, N. Y. H., for all labor and materials required for alterations providing for dining hall, second floor, Kitchen and Laundry Building, at U. S. Immigrant Station, Ellis Island, N. Y. H.

Cincinnati, O.—Until noon, Jan. 6, by Clerk Board of Education, for the construction of a new high school building on the corner of Clifton Ave. and McMilan St. Information may be obtained from Henry Klein, Superintendent of Buildings, No. 910 Main St.

Painesville, O.—Until Dec. 16, by E. D. Heartwell, County Auditor, for labor and material for erection of cell work for county jail now in course of erection. J. Milton Dyer, Architect, Cuyahoga Bldg., Cleveland, O.

Philadelphia, Pa.—Until 2:30 p. m., Dec. 9, by Board of Education, for repairs, etc., to school buildings.

Pittsburg, Pa.—Until noon, Dec. 6, by F. P. Booth, County Controller, for repairs to County Court House.

Pine Ridge, S. Dak.—Until 2 p. m., Jan. 18, for constructing dairy barn at Pine Ridge Agency.

Richmond, Va.—Until 3 p. m., Dec. 26, by C. P. Walford, Clark and Supervisor, City Hall, for construction of a high school building. Charles K. Bryant, Architect.

Ladysmith, Ont.—Until Dec. 11, by Fred Gelinas, Secretary, Department Public Works, Ottawa, Ont., for construction of a public building here.

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Denver, Colo.—Until noon, Dec. 7, by T. W. Jaycox, State Engineer, for construction and repair of 1 2-3 miles of wagon road near Jamestown.

Indianapolis, Ind.—Until 10 a. m., Dec. 6, by Board Public Works, for improvement of Hiawatha St. by grading, graveling and rolling the roadway.

Kansas City, Mo.—Until 2 p. m., Dec. 10. by Everett Elliott, Secretary Board Public Works, for grading the north sidewalk space on 15th St. from Topping Ave. to about 150 ft. west.

St. Louis, Mo.—Until noon, Dec. 10, by W. B. Dryden, Secretary Board Public Improvements, for 34 contracts for improving alleys, by grading and paving with vitrified brick.

Camden, N. J.—Until 11 a. m., Dec. 9, by Fred W. George, Clerk Board County Freeholders, for building gravel road from Berlin to Tansboro, a distance of 2.33 miles. J. J. Albertson, County Engineer.

Salem, N. J.—Until 8 p. m., Dec. 10, by Road Committee, County Freeholders. John F. Ayars, Director, for grading and placing oyster shells on Mannington Road (1.58 miles) in Mannington Township.

Brooklyn, N. Y.—Until 11 a. m., Dec. 11, by Bird S. Coler, Borough President, for two contracts for regulating and paving with asphalt, one contract for regulating and repaving with asphalt and one contract for regulating, grading and paving with granite. Largest contract calls for improvement of Grafton St., the work including 2,965 sq. yds. asphalt pavement and 415 cu. yds. of concrete.

Buffalo, N. Y.—Until 11 a. m., Dec. 6, by F. G. Ward, Commissioner Public Works, for paving portions of Detroit St., and Holt St., and for repaving portions of Lafayette Ave., Pine St., and Bean Alley.

Dayton, O.—Until noon, Dec. 4, by W. A. Maynes, Clerk Board Public Service, for the following: 1,500 sq. yds. brick repaving, 100 sq. yds. asphalt repaving, 6,000 lin. ft. boulder repaving.

Madisonville, O.—Until noon, Dec. 11, by J. A. Conant, Village Clerk, for the improvement of Archer Ave. from Central Ave. to Burch St., by grading and constructing the necessary drains, walls, culverts, etc.

Columbus, O.—Until noon, Dec. 11, by Edward F. McGuire, Secretary Board Public Service, for improvement of portions of following streets: Champion Ave., 18th St., Frambes Ave., Forest St., Kendal Pl., Long St., Leonard Ave., Mitchell St., Parsons Ave., 17th St., 6th Ave., 13th Ave., Woodruff Ave.

Erie, Pa.—Until Dec. 16, by Board Public Works, for repairing French St.

Harrisburg, Pa.—Until Dec. 16, by Joseph W. Hunter, State Highway Commissioner, for construction of 5,280 ft. of road, 16 ft. wide, in Londonderry Township.

Memphis, Tenn.—Until Dec. 5, by Ennis M. Douglas, City Register, for paving portion of Laclede Ave. with gravel.

Salt Lake City, Utah.—Until 8 p. m., Jan. 3 (change of date), by F. J. Leonard, Chairman Board Public Works, for grading, curbing and paving First South St., the work including 60,000 cu. yds. grading, 17,000 lin. ft. curbing and 41,000 sq. yds. asphalt pavement. Louis C. Kelsey is City Engineer.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Evansville, Ind.—Until 2 p. m., Dec. 28, by Walter F. Wunderlich, Clerk Board Public Works, for constructing 10-in. vitrified pipe sewer in 7th Ave.

Indianapolis, Ind.—Until 10 a. m., Dec. 9, by Board Public Works, for constructing local sewers in Owosso Ave., 21st St., 29th St. and 26th St.

Indianapolis, Ind.—Until 10 a. m., Dec. 6, by Board Public Works, for constructing local sewer in first alley north of 26th St.; also for constructing local sewer in first alley north of 30th St.

St. Paul, Minn.—Until 2 p. m., Dec. 12, by R. L. Gorman, Clerk Board Public Works, for constructing sewer in Fairview Ave. and sewer in Hoffman Ave.

Reno, Nev.—Until Dec. 9, by City Clerk, for labor for excavating and backfilling for construction of south side sewer system.

Brooklyn, N. Y.—Until 11 a. m., Dec. 11, by Bird S. Coler, Borough President, for constructing sewer in 44th St., estimated to cost $14,343, and sewer in East 4th St., estimated to cost $9,682; also for constructing four sewer basins. Largest contract includes construction of 762 lin. ft. of 36-in. brick sewer, 801 lin. ft. of 15-in. pipe sewer, 895 lin. ft. of 12-in. pipe sewer, and 3,100 lin. ft. of 6-in. house connection drain.

Dayton, O.—Until noon, Dec. 4, by W. A. Maynes, Clerk Board Public Service, for furnishing and laying following: 2,000 ft. 5-in, 2,000 ft. 6-in., 50,250 ft. 8-in., 8,100 ft. 10-in., 1,500 ft. 12-in., and 6,200 ft. 15-in. vitrified pipe sewer.

Lorain, O.—Until noon, Dec. 9, by Board Public Service, G. N. Damon, Clerk, for labor and material for constructing brick storm water sewer in Penfield Ave., Sewer District No. 4. Certified check for $1,000 required with bid.

Steubenville, O.—Until noon, Dec. 9, by T. W. Vance, Clerk Board Public Service, for constructing sewer in Market St.

Springfield, O.—All bids received Nov. 20 by F. A. Crothers, Clerk Board Public Service, for constructing portion of high level intercepting sewer, were rejected, and new bids are being asked until noon, Dec. 18. Three bids were received Nov. 20, only one of these being formal. The work includes 2,096 ft., 24-in.; 5,554 ft., 30-in., and 2,166 ft., 33-in. pipe or concrete sewer and 17,875 cu. yds. rock excavation. W. H. Sieverling is City Engineer.

Toledo, O.—Until noon, Dec. 9, by Reynold Voit, Clerk Board Public Service, for construction of local sewers Nos. 1011 and 1014.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Atlantic, Ia.—Until Dec. 7, according to reports, by this city, for labor and materials for drilling two wells; also for furnishing castings, valves and fittings, 1,000 water meters, high duty pumping engine, and a power pump.

McComb, Miss.—Until Dec. 17, by Mayor and Selectmen, for sinking artesian well at water plant. J. Dock Harrell, City Clerk

Dayton, O.—Until noon, Dec. 4, by W. A. Maynes, Clerk Board Public Service, for labor and materials for following work: 500 ft. 12-in. cast iron pipe, 2,800 ft. 5-in. cast iron pipe, 2 tons specials, 2,800 ft. of 5-in. wrought iron pipe, 8 5-in. gate valves, 30,000 B. M. of sheeting left in trench, 1 pair pneumatic lifts (capacity each 600 gallons per minute), 1 cast iron chamber for lifts, including excavation and back fill, 1 concrete chamber for lifts, including excavation and back fill.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

Muscatine, Ia.—Ditch Work.—Until noon, Dec. 7, by A. S. Lawrence, County Auditor, for excavating ditches in Drainage District No. 3, and for furnishing and placing additional cast iron pipes or concrete conduits at cross levee in Secs. 5 and 6.

Sac City, Ia.—Ditch Work.—Until Dec. 10, by J. J. Harter, County Auditor, for constructing two ditches.

Webster City, Ia.—Drainage Ditches.—Until Dec. 14, by O. A. Cragwich, County Auditor, for constructing Drainage Ditch No. 31 and Drainage Ditch No. 32.

Mount Vernon, Ind.—Drainage Work.—Until Dec. 20, by Drainage Commissioner of Posey County, for construction of a ditch and drain.

New Orleans, La.—Levee Work.—Until Dec. 16, by Maj. J. F. McIndoe, U. S. Engineers, 1539 Louisiana Ave., for constructing 771,600 cu. yds. of levee work in Lower Tensas, Atchafalaya and Ponchartrain levee districts.

Brooklyn, N. Y.—Grading Lot.—Until 11 a. m., Dec. 11, by Bird S. Coler, Borough President, for grading lot on northeast corner of 10th Ave. and Sherman St., the work including 389 cu. yds. earth excavation and 163 cu. yds. of earth filling.

McDougall Chutes, Ont.—Railroad Work.—The J. H. Reynolds Construction Co., McDougall Chutes, have received contract for 150 miles of work in Northern Ontario and Quebec, and will be ready to let the work soon after Dec. 1. The work consists of grading (earth and rock, principally earth), mostly steam shovel work to be done with small cars and track; also concrete work and tie contracts. Official advertisement will be found elsewhere in this issue.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Metal Work.—Until noon, Dec. 21, by District Commissioners, for furnishing four metal lions (dimensions, base about 7 ft. x 12 ft., height about 9 ft.) for Connecticut Ave. bridge. Blank forms of proposals and all necessary information may be obtained at Room 43, District Bldg.

Paducah, Ky.—Tenders.—Until 11 a. m., Dec. 27, by Maj. Wm. W. Harts. U. S. Engrs., Nashville, Tenn., for building two wooden hull steam tenders.

Boston, Mass.—Wreck Removal.—Until noon, Dec. 27, by Maj. Edw. Burr, U. S. Engrs., for removal of wreck of steamship "City of Birmingham," lying in Upper Main Ship Channel, Boston Harbor.

New York, N. Y.—Street Lighting.—Until 2 p. m., Dec. 10, by John H. O'Brien, Commissioner Water Supply, Gas and Electricity, 13 Park Row, for lighting streets, avenues and public buildings of various boroughs of New York City.

New York, N. Y.—Trimming Scows, Etc.—Until noon, Dec. 12, by Foster Crowell, Commissioner of Street Cleaning, 13 Park Row, for furnishing all the labor and materials required for loading and trimming deck scows and other vessels of the Department, and for the privilege of sorting and picking over and appropriating certain of the refuse of the dumps. Security required is $5,000.

Columbus, O.—Garbage Works.—Until noon, Jan. 14, by E. F. McGuire, Secretary Board Public Service, for the construction of garbage reduction works in accordance with specifications on file in the office of said Board and in the custody of Henry Maetzel, Chief Engineer, Department of Public Service. The work consists of the design, construction, delivery and erection of the reduction works complete, on land owned by the City of Columbus. The works will have a capacity of 100 tons per 24 hours.

Materials, Machines, Supplies, Tools, Etc.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Milling Machine, Etc.—Until 10 a. m., Dec. 17, by Bureau Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yard, Washington, a quantity of naval supplies, as follows: Sch. 538—Milling machine. Sch. 587—Hewitt lamps. Sch. 590—Rubber boots, pump, oil stones, air drills, saws for milling machine, hardware, copper, steel.

Washington, D. C.—Electrical Materials.—Until 10:30 a. m., Dec. 23, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Canal Circular 405: Electrical material, consisting of cable, wire, flexible conduit, wire attachments, switches, push buttons, shade holders, annunciators, bells, lamp shades electroliers, incandescent globes, dry cells, wire grips, bit braces, blow torches, fire pots, miter boxes, solder insulating compound, red fiber, tape, screws, staples, rubber gloves, linemen's belts, etc.

Washington, D. C.—Pipe, Chain, Rope, Etc.—Until 10:30 a. m., Dec. 27, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Circular 406: Sanitary fixtures, valves, wrought iron pipe, conductor pipe, copper tubing, condenser tubes, compressed air reheater, repair parts for unloaders and dump cars, rail braces, wheeled scrapers, steel, bar iron, pig iron, copper, tin, antimony, rivets bolts, lag screws, tacks, chain, wire rope, wire cloth, ball bearings, shovels, tool handles, wrenches, turnbuckles, wire rope clips, belt fasteners, soldering coppers, tackle blocks, chain blocks, flue brushes, car locks, paddocks, door hardware, steam gauges, steam whistles, wing dividers, watchmen's watches, lumber, etc

Atlantic, Ia.—Meters, Pump, Etc.—See under Bids Asked—Water Supply.

Chicago, Ill.—Gate Valves.—Until 11 a. m., Dec. 13, by Department Public Works, room 317, City Hall, for furnishing following gate valves for cast iron water mains: 50 4-in. valves, 360 6-in. valves, 325 8-in. valves, and 100 12-in. valves.

Chicago, Ill.—Ferrules.—Until 11 a. m., Dec. 13, by Department Public Works, Room 317, City Hall, for furnishing following brass corporation ferrules: 12,000 ¾-in. ferrules, 500 1-in. ferrules, 100 1¼-in. ferrules, 400 1½-in. ferrules and 250 2in. ferrules.

Chicago, Ill.—Lubricating Oil.—Until 11 a. m., Dec. 13, by Department Public Works, 325 City Hall, for furnishing and delivering lubricating oils for use at the various city water pumping stations during the term beginning Jan. 1, 1908, and ending Dec. 31, 1908.

Annapolis, Md.—Pipe Fittings, Etc.—Until 10 a. m., Dec. 10, by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Naval Academy, Annapolis, Md., a quantity of pipe fittings, oil burner, forge. Applications for proposals should refer to Schedule 570.

Ashville, O.—Arc Lamps, Wire.—Until Dec. 20, by W. P. Powell, Village Clerk, for furnishing f. o. b., Ashville, arc lamps and copper wire necessary in connection with the installation of the proposed system of street lighting.

Winnipeg, Man.—Water Pipe.—Board of Control, Magnus Peterson, Secretary, has extended time for receiving bids for 15 miles of assorted water pipe from Nov. 15 to Jan. 15.

CONTRACTS LET.

The following contracts have been let recently:

Mobile, Ala.—Locks.—P. H. O'Brien, Anniston, Ala., at about $1,000,000, for constructing locks Nos. 2 and 3 on the Tombigbee River for U. S. Government.

Birmingham, Ala.—Paving.—Southern Bitulithic Co. of Nashville, Tenn., additional contract for 2,500 sq. yds. of bitulithic here.

Huntsville, Ala.—Paving Brick.—Gray Shale Paving Brick Co., Birmingham, Ala., for furnishing city with vitrified brick for street paving.

Sacramento, Cal.—Bridge Work.—Jenkins & Wells, at $5,388, for repairing American River bridge, work including placing brush mattresses anchored to concrete blocks; McDougall & Kennedy, at $13,795, for reconstruction of American River trestle.

Denver, Colo.—Electrical Equipment.—Northwestern Electric Equipment Co. of St. Paul, Minn., for the electrical equipment of the auditorium. The work was let by the National Surety Company, and includes a complete electrical plant that will cost $40,000.

Iowa City, Ia.—Bridge.—Iowa Bridge Co., Des Moines, Ia., at $26,500, for bridge over Iowa River at this place.

Peoria, Ill.—Bridge Work.—Missouri Bridge & Iron Co., St. Louis, Mo., at $912, for constructing 32 ft. steel bridge in Rosefield; Schmitt Construction Co., Peoria, Ill., at $1,190, for 35 ft. steel bridge in Rosefield; Missouri Bridge & Iron Co., at $1,882, for 75 ft. span steel bridge on concrete abutments in Chillicothe.

Iowa City, Ia.—Bridge.—Iowa Bridge Co., at $26,450, for construction of new park bridge, to consist of three spans, 175 ft. each, with 18 ft. roadway.

Richmond, Ind.—Sewer.—Hipskind & Son, Wabash, Ind., at $11,700, for constructing sewer from Sheridan St. to west line of West 5th St.

Indianapolis, Ind.—Paving, Grading, Etc.—Marion County Construction Co., Indianapolis, for paving with brick Stillwell St.; Henry Pothast, for grading in Houston St.; L. J. Cooper & Co., for brick paving in Chesapeake St.; John Arnold, for cement walks on Michigan St.; L. J. Cooper & Co., for brick roadway on Walnut St.; Hoosier Construction Co., for bitulithic paving in Hoyt Ave.

Terre Haute, Ind.—Roadwork.—W. M. Fiffin, for building Dickinson Road in Lost Creek Township, and W. C. Dorsey for building Roberts Road in Otter Creek and the Cox Road in Fayette.

Pittsburg, Kan.—Sewer, Ditch.—W. W. Cook, at $2,677, for constructing sewer laterals 10a and 7a; Seibert & Johnson, for drainage ditch in 2nd ward.

Charleston, Mo.—Ditch Work.—H. G. Harding, Laporte, Ind., at about $200,000, for digging canal about 40 miles long, involving handling 2,040,000 cu. yds. of earth.

Malaga, N. J.—Road.—J. Sheppard Fisler, Clayton, N. J., at $12,911, for constructing Malaga and Downstown Road.

Albany, N. Y.—Road Work.—Stewart-Kerbaugh-Shanley Co., New York City, at $155,414 for constructing three state roads in Onondaga County.

Rochester, N. Y.—Subway.—J. W. Dwyer & Son, Buffalo, N. Y., and Houston Barnard, at $120,000, for excavation and mason work at Culver Road subway for N. Y. C. & H. R. R. R.

Winston, N. C.—Bitulithic Pavement.—Atlantic Bitulithic Co., of Richmond, Va., for 72,000 sq. yds. of bitulithic.

Kings Mountain, N. C.—Lighting System.—Harkey & Pahe, Charlotte, N. C., for installing electric lighting system here.

Dayton, O.—Ditch.—Portland Tile Co., at $1,485, for Peffly ditch in Clay Township.

Piqua, O.—Bridge.—Wynkoop & McGormley, Toledo, O., at $25,227, for sub and superstructure of bridge over Stillwater River near West Milton.

Toledo, O.—Pavement.—H. P. Streicher & Co. of Toledo for laying 6,325 sq. yds. of bitulithic in this city.

Eugene, Ore.—Paving.—Warren Construction Co., Portland, Ore., for 2,834 sq. yds. of bitulithic in this city.

Troy, O.—Bridge Work.—Fauner & Reuch at $5.95 per cu. yd. for substructure of Milton bridge and $9.95 per cu. yd. for reinforced concrete culverts.

Portland, Ore.—Bitulithic.—Warren Construction Co., Portland, for an additional contract for 15,802 sq. yds. of bitulithic.

Salem, Ore.—Pavement.—An additional contract for 14,429 sq. yds. of bitulithic has been awarded to the Warren Construction Co. of Portland, Ore.

Harrisburg, Pa.—Road Work.—McCormick & Co., at $18,000, for construction of Paxtang Pike.

Pittsburg, Pa.—Memorial Hall.—P. W. Finn, Altoona, Pa., at $873,000, for constructing a memorial hall for Allegheny County. Bids were opened Nov. 25. Granite and terra cotta construction.

Newport, Pa.—Sewers.—Brady & Snavely, Harrisburg, for constructing sewers here.

New Castle, Pa.—Sewers.—Louis Moyer, for constructing Scioto and Blaine sts. sewers; Ferry & Co., for sewer in Winter ave.

Columbia, S. C.—Paving.—Georgia Engineering Co., Augusta, Ga., at $173,559, for paving Main st. with vitrified brick.

Richmond, Tex.—Bridge.—E. P. Alsbury, Houston, Tex., for constructing joint county steel bridge over Bernard River at Schley Crossing.

Manitowoc, Wis.—Bridge Work.—W. E. Pellet, Manitowoc, at about $6,000, for widening drawbridge of Wisconsin Central Ry.

Vancouver, Wash.—Paving.—Warren Construction Co., Portland, Ore., for 36,987 sq. yds. of bitulithic here.

Port Arthur, Ont.—Paving.—The Warren Bituminous Paving Co., Toronto, Ont., for 6,593 sq. yds. of bitulithic.

Toronto, Ont.—Bitulithic.—Warren Bituminous Paving Co., Toronto, for additional contract of 2,432 sq. yds. of bitulithic.

PROJECTED WORK.

Bridges.

Items Arranged Alphabetically by States.

Red Bluff, Cal.—County Surveyor Luning has completed plans for a 360 ft. I-beam bridge to span Paynes Creek Slough on the Cone Road, one mile east of Red Bluff. Bridge will have 12 spans of 30 ft. each resting on concrete piers and will be 18 ft. wide.

Oroville, Cal.—Northern Electric Ry. Co. is to ask County Supervisors for franchise to construct toll bridge over Sacramento River.

Quincy, Cal.—County Supervisors are to have following bridges erected: Long steel bridge will be built over Spanish Creek near Quincy; a steel bridge over Spanish Creek at Spanish Ranch; steel bridge on the North Fork of Feather River, near Big Springs; and two long approaches to the La Porte bridge. In addition, the Bates bridge in Sierra Valley will be erected and steel approaches to the Flournoy bridge will be built on the north side. The main span of the same bridge will be rebuilt, and new bridges will be built over Clear Creek, at Cadle Land and Wolf Creek, near Greenville.

San Francisco, Cal.—The Harbor Board is considering construction of a $40,000 bridge over East St.

Waterloo, Ia.—Commission of which C. T. Wilson, City Engineer, was a member, has reported that an opening could be made in the embankment of the W. C. F. & N. Ry. Co., at the Sans Souci cutoff and a through-plate girder bridge erected at a cost of $7,500.

Carbon Cliff, Ill.—Supervisors of Rock Island County, Rock Island, Ill., and Supervisors of Henry County, have decided to build a highway and railway bridge over Rock River near this place. Bridge will cost about $40,000 and work is to be started in the spring.

South Bend, Ind.—Following bids were received Nov. 22 by County Commissioners for construction of east race bridge at La Salle Ave.: C. L. Copp, South Bend, Ind., $13,234; Marsh Co., Des Moines, Ia., $16,764; Falkenau Construction Co., Chicago, Ill., $14,248; Elkhart Construction Co., Elkhart, Ind., $17,500.

Indianapolis, Ind.—Commissioners of Marion County will shortly ask bids for extensive repairs to the Dorman St. bridge over Pogues Run.

Hutchinson, Kan.— Hutchinson-Kansas Salt Co. will build a bridge over Arkansas River at Monroe St. County will pay $2,000 as its share of the cost. A bridge will also be built across the Arkansas River at 17th St. by the county.

Detroit, Mich.—City Engineer has been directed to draw plans and prepare estimates for the construction of a new Belle Isle bridge and also for removing present bridge to be used at a point opposite the upper end of the island.

Lansing, Mich.—City Engineer is preparing plans for new bridge over Cedar River at Cedar St.

Duluth, Minn.—City is considering construction of viaduct over railroad tracks from Banks Ave. and Third St. City Engineer estimates cost of steel viaduct at about $20,000. Replacing of present wooden bridge with steel structure would cost about $9,000.

St. Louis, Mo.—City Council has passed over Mayor Wells' veto the bill for a free bridge across the Mississippi River at Chouteau Ave., for which the people voted to issue $3,500,000 bonds.

Newark, N. J.—Local Board of Trade has adopted resolution to the effect that steps should be taken to compel the Central Railroad of New Jersey to build a new bridge in place of its present one across Newark Bay. Mayor Haussling is to urge City Council to action.

Cleveland, O.—Plans are now under way for the high level bridges to be constructed by the city over the Cuyahoga River. William J. Carter is City Engineer.

Cleveland, O.—Eastern Ohio Traction Co. proposes to erect a bridge over the Chagrin River, near its Chagrin Falls power plant.

Portland, Ore.—Plans are being made by engineers of the Harriman lines for the construction of a new bridge over the Willamette to replace the present steel structure. G. W. Boschke, Portland, Ore., is Chief Engineer, Oregon R. R. & Navigation Co.

Railroads

Items Arranged Alphabetically by States.

Augusta, Ga.—Surveys are now under way for location of projected line of Savanah, Augusta & Northern Ry. The route from Comer to Commerce and thence to Gainesville is now being located. Recently Washington, Ga., raised $75,000 to insure the road touching that city. Cecil Gabbett, Savannah, Ga., is interested.

Pekin, Ill.—Double tracking of Peoria & Eastern Division of Cleveland, Cincinnati, Chicago & St. Louis Ry., between Pekin and Bloomington, is under consideration. A. L. Kuehn, Cincinnati, O., is Engineer Track and Roadway.

McAlester, Ind. T.—Surveys are being made by Missouri, Kansas & Texas R. R., for extensive improvements in the yards and changes in the main line near this city. This change is in accord with the plan of the Katy to double its entire line from Denison to Muskogee and later to Parsons. The road is now being double tracked south of Atoka and upon the completion of the stretch from Denison to Atoka the improvements in the line from that point will be extended to McAlester. J. W. Petheram, Dallas, Tex., is Chief Engineer.

Lake Charles, La.—Advices from this place state that financial arrangements for building the New Iberia, St. Martin & Northern R. R. are progressing favorably and the completion of the line in time to handle next year's crop is practically assured. Rights of way between Abbeville and Broussard, the junction point on the New Iberia line is now being received. F. M. Welch is president of the road.

Okalona, Miss.—Surveys for the Aberdeen & Tombigbee Ry., which is to extend from this place to Pickinsville, Ala., 65 miles have been completed, and grading is finished between Okalona and Aberdeen, 17½ miles, and Columbus and Pickinsville. The road, which is being built principally for lumber traffic, is being constructed by the company with its own forces.

Atlantic City, N. J.—Pennsylvania R. R. is to improve its terminal facilities at this place. Its tracks will be elevated from the drawbridge to the present station and the new station will be at Atlantic Ave. South Carolina and Tennessee Aves. will be widened in order to establish a park at the terminal, and there will be a boulevard from the station and park to the inlet. Alex. C. Shand, Philadelphia, Pa., is Chief Engineer.

Trenton, N. J.—Plans are being completed by the Pennsylvania R. R. for the double tracking of the Belvidere Division from Trenton to Mauch Chunk. Work will probably be started in the spring.

Sulphur, Okla.—Steps are being taken to finance the St. Louis, Springfield, Oklahoma & Western R. R. Co., which proposes to construct a road from Sallisaw, Okla., to McAlester, Coalgate, Sulphur, and to Lawton, passing from the eastern part of old Indian Territory down through the south central portion, then west to Lawton. Sixty miles of the 250 miles of right-of-way has already been granted by the property owners, and it is expected that the construction work will be started within the next six months. W. A. Squires, President North Texas & Oklahoma Promoting Co., is promoting the project.

Newport, Pa.—Stockholders of Newport & Sherman's Valley R. R. Co., are to vote Dec. 21 on increasing capital stock from $125,000 to $250,000. The proceeds will be used for improvements, it is said. The road is 30 miles long, 3 ft. gage. David Gring, Newport, is president.

Philadelphia, Pa.—Tentative plans are to be prepared by George S. Webster, Chief Engineer Bureau of Surveys, for the elevation of the Pennsylvania R. R. tracks in Washington Ave. He has recommended the building of a steel elevated structure in that street from the Delaware to the Schuylkill River. The cost of the work is roughly estimated at $8,650,000.

Timpson, Tex.—Timpson & Northwestern R. R. has been practically completed within 14 miles of Henderson, and it is said that contracts for completion of the line to that point will be let shortly. M. C. Duffy, Timpson, Tex., is Chief Engineer.

Spokane, Wash.—Local press reports quote D. C. Corbin, Spokane, President of Spokane International Ry. as stating that that road would be at once extended to Seattle, where dockage facilities would be arranged.

Evenwood, W. Va.—Charter has been applied for by Sewell Valley R. R. Co. which proposes to build a line from the mouth of Big Sandy creek, in Greenbrier county, to the mouth of Meadow Creek, in Summers county. Capital stock is $100,000, and headquarters are at Evenwood. The incorporators are T. W. Raine of Evenwood, C. W. Harding and Leslie Harding of Beverly, W. Va.; Charles E. Andrews, Jr., of New Bethlehem, Pa., and John Raine of Granville, O.

Vancouver, B. C.—Advices from this city state that the Canadian Pacific Ry. will rush work on the construction of its line across Vancouver Island between Wellington and Alberni, and the clearing of 56 miles right of way will be completed this winter. H. B. Walkem, Vancouver, B. C., is Resident Engineer C. P. Ry.

Toronto, Ont.—Canadian Northern Ontario Ry. has applied to the Dominion Parliament for permission to build a branch line from James Bay Ry. to Orilla. W. Mackenzie, Toronto, is President.

Ottawa, Ont.—Canadian Northern Quebec Ry. has applied to the Dominion Parliament for permission to build from St. Jerome to St. Eustache, and from Ottawa via Hawkesbury to Montreal, branching on Montreal Island to enter the city from the northeast and southwest. The same company has also asked authority to construct eight western branches. H. K. Wicksteel, Montreal, Que., is Chief Engineer.

Kentville, N. S.—Application has been made to the Dominion Parliament by the Dominion Atlantic Ry., for authority to build a branch line from Kentville or Canning westerly. W. Yould, Kentville, is Engineer.

Electric Railways.

Items Arranged Alphabetically by States.

Little Rock, Ark.—It is expected that necessary amount of stock will be placed here by Dec. 15th to insure construction of Little Rock & Hot Springs Interurban Ry. Hot Springs has already taken its allotment. L. Garrett is Vice President and General Manager of the projected road.

Atlanta, Ga.—Atlanta & Carolina Electric Ry. Co., Matthew Mason, General Manager, is said to be perfecting plans for the purchase of the old survey of the Seaboard Air Line between Augusta and Athens for an electric line from Atlanta via that city to Augusta. The contract for the construction of the entire line from Augusta to Atlanta is said to have been let to an Atlanta firm.

Mount Vernon, Ind.—Tentative plans are being discussed by Illinois capitalists for an electric line from Mt. Vernon, Ind., to Mt. Vernon, Ill., connecting with the St. Louis lines and the Evansville line. The proposed route would include Fairfield, Grayville, Albion and New Harmony, Ind., and would be for passengers and freight.

Bedford, Ind.—City Council has granted 50-year franchise to the Grand Central Traction Co. for the use of the streets of Bedford and to construct and operate an electric light and heating plant.

Nappanee, Ind.—Citizens of this place are reported to have made a tentative standing offer of $35,000 to encourage the building of an electric line into Nappanee.

Carlisle, Ia.—This place has voted to grant a franchise to the McKittrick Brick & Tile Co., for the construction of an electric line from the bed of clay and shale to the operating factory. The company had decided to put in this line so as to handle the business better.

Lawrence, Kan.—Messrs. J. A. Thurber and E. A. Dye, of Logan, Kan., are considering asking franchise for electric railway here.

Salina, Kan.—Salina Street & Interurban Ry. Co., G. E. Harris, Treasurer, is said to be making arrangements to change its gasoline motor car system to an electric system.

Fryeburg, Me.—Fryeburg Horse Railroad Co., operating 4½ miles of line here, proposes to extend its tracks to Stow and Lowell on the north and to Cornish on the south, where it may connect with a proposed line from Sanford. E. E. Hastings, Fryeburg, is interested.

Tekamah, Neb.—Construction of a road between this place and Decatur, to be operated with the McKeen gasoline motor cars, is under consideration. A committee consisting of H. D. Byram, E. A. Hanson, C. H. W. Busse, of Decatur, and J. P. Latta and A. M. Anderson, of Tekamah, was appointed to promote the building of the road and negotiate for the construction of the cars and the right-of-way.

Akron, O.—Articles of incorporation have been applied for by L. Chillis and others for the Akron & Youngstown Electric Railway Co. Capital stock is to be $100,000, and work is to begin at North Jackson within 30 days, it is said. The road is to be an air line between Youngstown and Akron, and a final link between Cleveland and Pittsburg.

Greenlane, Pa.—Town Council has granted franchise to Perkiomen Valley Traction Co. for a line from Greenlane to Collegeville.

Monongahela City, Pa.—Charter of Monongahela & Carroll Street Ry. Co. has been approved by the Governor. Capital stock is $12,000 and company proposes to build two miles of road in Monongahela City. The directors are E. B. Hartman, Jr., W. D. McBryar, E. W. Marshall, W. S. Walsh and W. E. Walsh, Pittsburg.

Morgantown, Pa.—Surveys have been started to locate route of projected Morgantown, Masontown & Smithfield Railway. Franchises have been secured at Point Marion, Springfield and other places and it is expected to begin construction work within six months. The road is to run from Morgantown to Pittsburg by way of Point Marion, Smithfield, Masontown, Waynesburg, Zollarsville and other points in Greene and Washington counties. The distance from Morgantown to Pittsburg by the new road will be 59 miles. W. J. Sheldon, McKeesport, Pa., is interested. E. M. Wilkins, Pittsburg, Pa., is Chief Engineer.

West Chester, Pa.—Application has been made for a charter for the West Chester & Wilmington Electric Railway. Projected length of line is 17 miles and necessary capital for construction is said to have been received. The following are interested: Thomas E. O'Connell, West Chester; Casper P. Faucett, Westtown; James A. Kirkpatrick, Birmingham; Charles Gleason, Brandywine Summit; Wills Passmore, Brandywine, Del.; F. Harry Day, M. D., Talleyville, Del.; M. A. O'Connell, West Chester.

Providence, R. I.—Massachusetts State Board of Railroad Commissioners has authorized Boston & Providence Interurban Electric R. R. Co. to build a road from a terminus at Forest Hill at the Boston end through the towns of Hyde Park, Dedham, Westwood, Norwood, Canton, Sharon, Foxboro, Mansfield, Attleboro and Seekonk to the State line.

Charleston, S. C.—It is now said that work on the construction of the electric railway between this place and Summerville will be resumed shortly and pushed to completion. Gen. A. J. Warner, Summerville, S. C., is interested.

Sumter, S. C.—Mr. J. L. Alnut has petitioned City Council for franchise for street railway and gas plant.

Fairmont, W. Va.—Fairmont & Clarksburg Traction Co. has asked franchise to build electric railway from Main St. down Park Ave. to the new river bridge.

New Martinsville, W. Va.—Business men of New Martinsville and Middlebourne, have taken preliminary steps for the construction of an electric railway between the two cities.

Electric and Gas Plants.

Items Arranged Alphabetically by States.

Fort Smith, Ark.—Nelson Investment Co. has been incorporated with a capital stock of $100,000 to construct electric lighting plants, etc. J. T. Nelson is President.

Leesburg, Fla.—Mayor Dozier is advocating bond issue for installing electric light system.

Americus, Ga.—American Railway & Light Co. proposes to erect power plant here.

Blue Ridge, Ga.—City has voted to issue $30,000 of bonds for water works and electric lights.

Tabor, Ia.—F. G. Wilcox and H. W. Clark are taking steps to organize a company for the purpose of installing electric lights in Tabor.

Oquawka, Ill.—City proposes to purchase the local electric lighting plant and run it as a municipal plant.

Logansport, Ind.—L. L. Truman has asked franchise for installing heating plant here.

Wichita, Kan.—A company to be known as the Wichita Heat, Light, Power & Space Co., capital $250,000, is to be formed here to build a heat, power and light and space plant for the purpose of encouraging and aiding small manufacturers.

Charlotte, Mich.—Michigan Power Co., Lansing, Mich., is asking franchise here for power purposes. It proposes to expend about $75,000 in constructing power line, from its plant at Diamondale.

Louisville, Ky.—The Kentucky Electric Co. has increased its capital stock from $500,000 to $600,000.

Jackson, Mo.—A. E. Hecker, of Tallula, Ill., proposes to install an electric light plant here.

Princeton, N. J.—Trustees of Princeton Theological Seminary are planning to install a heating and lighting plant.

Akron, O.—The Valley Power Co., of this city, has been incorporated; capital stock is $50,000. Harry A. Williams, of Cuyahoga Falls; James G. Stewart and Frank T. Marton, of Kent, are interested.

Canal Dover, O.—Bond issue has been voted to erect municipal electric light and power plant.

Mansfield, O.—Mansfield Railway, Light & Power Co. proposes to spend $100,000 in improving its power plant in this city.

Milford Center, O.—Local electric light plant and waterworks have been purchased by Edw. A. Schambs, Richwood, O.

Greenlane, Pa.—Town Council is considering a proposition to establish an electric light plant and obtain power from dams in the Perkiemen Creek.

McKinney, Tex.—An election was held Nov. 26, to vote on issuing $26,000 of bonds for a city park and the extension of the electric light and water system.

Mineral Point, Wis.—Mineral Point Electric Light Co. has increased its capital stock from $25,000 to $50,000.

Wheeling, W. Va.—Mozart Improvement Co. has been incorporated with a capital stock of $100,000 to build and operate electric power plants, etc. C. M. Kirschner and H. L. Hess are interested.

Fremont, Wyo.—The Big Horn Power Co., composed of members of the Boysen Mining Co., has been incorporated with a capital stock of $700,000 for the purpose of developing power from the river at the town of Boysen. The trustees and managers of the corporation are: Asmus Boysen, John M. Baldwin, L. C. Brorsen and others.

Toronto, Ont.—A by-law is to be submitted to the ratepayers on Jan. 1 to provide for raising $2,500,000 for the purpose of establishing a power and light distribution plant.

Sewers.

Items Arranged Alphabetically by States.

Sacramento, Cal.—City has voted to issue $200,000 of bonds to complete sewer system. Work will be done mostly in the eastern district.

Oakland, Cal.—C. D. Vincent was low bidder Nov. 20 for constructing sewer between E. 8th and E. 11th Sts.

Santa Monica, Cal.—City Council will receive until Dec. 21, plans, specifications and estimates for the construction of (1) a septic tank separately; (2) a wharf separately; (3) septic tank and wharf combined. The wharf is to be 1,600 ft. in length, and is for the purpose of carrying an outfall pipe from the septic tank. T. H. James, City Engineer, will furnish general plan and specifications on application.

Wilmington, Del.—Street and Sewer Department is considering means for diverting or disposal of sewage from Shipley Run sewer. A. J. Taylor is Engineer in charge of sewers.

Strawberry Point, Ia.—Town Council proposes to construct sewer system.

Moline, Ill.—Residents of 6th ward are advocating construction of sewer system for that section of city, and City Engineer is preparing tentative plans for such a system, estimated cost of which is $100,000.

Galva, Ill.—Board Local Improvement will expend $30,000 for constructing sewer system in north sanitary district.

Aurora, Ind.—Schofield Contracting Co., Madison, Ind., at $16,505, was only bidder for constructing sewer system No. 1. The bid was rejected. Chas. Brown, Indianapolis, Ind., is Engineer.

Muncie, Ind.—Board of Public Works is planning to ask for bids for the construction of a large sewer in Kilgon Ave. and Jackson St.

Indianapolis, Ind.—Charles A. Brown, Assistant City Engineer, has plans underway for a sewer in Spring St., from Ohio to Walnut St., with laterals running east in the alleys.

Richmond, Ind.—Board Public Works has rejected bid of Hipskind & Son, of $13,100 for building route 2 of Northwest 2nd St. sewer, and new bids are to be asked.

Tecumseh, Mich.—All bids for constructing sewer system for this city have been rejected and new bids will be taken after Jan. 1, it is said.

Detroit, Mich.—Plans are now being prepared in the City Engineer's office and will go to the council, probably by spring, for a new sewer system to drain not only the present end of the city, but also all the territory bordering Lake St. Clair as far as Grosse Pointe Farms.

St. Paul, Minn.—Following bids were received Nov. 18, for constructing St. Anthony Park sewer system: Fielding & Shepley, $330,575; M. J. O'Neill & W. J. Preston, $369,000; Nicholas Feyen & Keough Brothers, $349,993; Green Sons' Co., $365,000; General Contracting Co., $317,000. The city engineer's estimate was $279,800. The contract includes the laying of 66,080 ft. of sewer with 270 catch basins and 267 manholes, running over 20 streets.

St. Louis, Mo.—Board Public Works has bill before City Council for extension of Glaze Creek sewer through Carondelet Park to Kansas St. Bill authorizes expenditure of $140,000 for the work.

Mount Kisco, N. Y.—Village has voted to build sewers to cost $100,000. Of this sum $40,000 will be for trunk sewer and $60,000 for laterals. The city of New York will erect a disposal plant to cost $250,000 to care for the sewage of the village.

Cincinnati, O.—Plans have been submitted to the Council for a storm relief sewer from Freeman Ave. to Mill Creek and a branch in Colerain Ave. Plans have also been submitted for a complete sewer system in the former village of Westwood. E. F. Layman is Engineer of Sewers.

Mansfield, O.—Board of Health has recommended that the sewer system be extended in the northern part of the city at a cost of $7,000 to $8,000.

Mingo Junction, O.—This city is to sell on Dec. 23, $50,000 of bonds for constructing main sewer from Ravine St. to the Ohio River. Frank McAlister is City Clerk.

Scranton, Pa.—Director of Public Works Acker has recommended the construction of a septic tank and contact bed system disposal plant for handling sewage of part of the 10th ward, and Select Council has directed that plans and specifications be prepared. Estimated cost is $33,000.

Easton, Pa.—City Engineer McNeal is preparing plans and specifications for the separation of Easton's sewer system (house and surface water), in conformity with the expert report recently submitted to City Councils by A. P. Folwell, Consulting Engineer, New York City. A $241,000 bond issue for the improvement is to be voted on Feb. 18.

Yorkville, S. C.—City has voted to issue $25,000 of bonds for constructing sewer system and extending water works.

Juarez, Mex.—Thomas S. Shepperd, Municipal Engineer of Chihuahua, Mexico, has practically completed plans and specifications for a $125,000 sewer system for this city.

Water Supply.

Items Arranged Alphabetically by States.

Eureka Springs, Ark.—Plans for improvement of city reservoir at a cost of $12,000 are under consideration. C. D. James is Chairman Water Commissioners.

Barnesville, Ga.—Election has been ordered to vote on issuing bonds for enlarging water plant and extending mains.

Savannah, Ga.—Council Water Works Committee, Mr. Wilkinson, Chairman, is said to contemplate engaging engineer to inspect water works system and recommend improvements.

Anamosa, Ia.—A $30,000 bond issue for water works has been voted.

Garrison, Ia.—Town has voted to issue $5,000 of water works bonds.

Waterloo, Ia.—Highland Land Co. is to lay water mains in Highland addition.

Waterloo, Ia.—Committee, of which Mayor Rector is a member, is to open negotiations with the Waterloo Water Co. for the purchase of its plant by the city.

Terre Haute, Ind.—Terre Haute Water Works Co. has increased its capital stock from $220,000 to $280,000.

Claremore, Ind. T.—City has voted $40,000 of bonds for the extension of the water works. George W. Chalfont is Engineer in charge.

Cherokee, Kan.—A $6,000 bond issue for new tank and reservoir for city water works has been voted.

Meridian, Mich.—This city has voted to issue $196,000 of water works bonds.

Willamette, Ore.—Property owners of Willamette are figuring on purchasing the present water system owned by the Portland General Electric Co.

Lebanon, Tenn.—A $10,000 bond issue for establishing water works has been voted.

Denison, Tex.—City has secured an option on a 750 acre farm three miles west of

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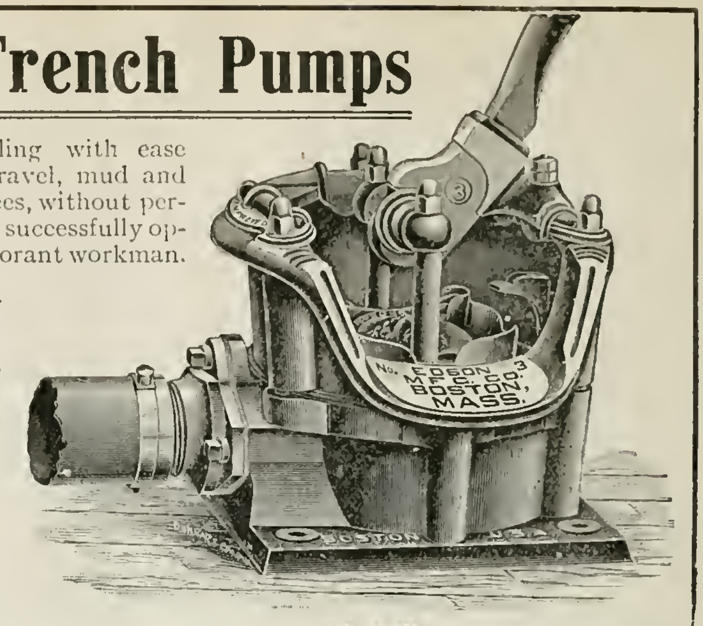

town which is to be used as a part of a water works plant.

Odessa, Wash.—A $20,000 additional bond issue has been voted by this town. Part of the proceeds will be used for replacing wooden mains with iron pipes.

Seattle, Wash.—Council has voted to construct a system of fire protection in salt water mains in the business district, to cost $340,000.

Gratiot, Wis.—City has voted $7,000 of bonds for water works.

Marinette, Wis.—City Council has voted to purchase local water works.

INDUSTRIAL NOTES

The Expanded Metal & Corrugated Bar Co. of St Louis, Mo., has just completed shipment of 1,000 tons of open hearth steel corrugated bars for the U. S. Reclamation Service. This material is being used on irrigation works in connection with the Tieton Project. This order is one of several the above company has received for corrugated bars for irrigation work.

Allis-Chalmers Company has engaged for its office in St. Louis, Mo., a new suite of offices located at 1302-1304 Third National Bank Building, where the Company's District Manager, Mr. F. L. Bunton, and the salesmen of his staff will be prepared to receive visitors after Jan. 1st, 1908.

The Twin City Equipment Co. of Minneapolis has purchased two acres of ground at the Minnesota Transfer, midway between Minneapolis and St. Paul, where they will build shops which will give employment to shovel engineers when idle, or passing thru and temporarily detained. Repairing of locomotives and steam shovels, mining and lumbermen's equipment, and machinery for making frogs and switches will be installed.

Concrete Piles are being used extensively at present for the foundations of buildings in localities where the soil is of an extremely poor character, the extent of their use being shown by the large number of contracts which are at present calling for the use of such foundations. Simplex concrete piles have been used for the foundations of the Fruit Auction Exchange Building, corner Franklin and Washington Sts., New York City; the foundations for the Isaac G. Johnson Steel Castings Foundry, on Spuyten Duyvil Creek, New York City; the refuse destructor for the Borough of Richmond, City of New York; the foundations for the addition to the plant of the Standard Oil Co. at Claremont Ave., Jersey City. The Foundation Co., 115 Broadway, New York City, has been awarded the contract for borings and for placing Simplex concrete piles in the foundations for a new refining plant for the S. T. Baker Oil Co., of New York City, at Elizabeth, N. J. These piles are to be used in the foundations of the tanks, the walls of the filling house, storage house and tank house.

The Cement Products Exposition Co., which is to hold its first annual cement show at the Coliseum in Chicago, Ill., on Dec. 16-21, reports that good progress is being made with the arrangements for the show. A large amount of exhibit space has already been allotted, a partial list of exhibitors to whom this space has been assigned being as follows:

Ashland Steel Range & Mfg. Co., Ashland.
Alling Construction Co., Chicago.
Anchor Concrete Stone Co., Rock Rapids.
Association of Portland Cement Manufacturers, Philadelphia, Pa.
American Steel & Wire Co., Chicago.
American Lumberman, Chicago.
Architectural Cement Works, Chicago.
American System of Reinforcing, Chicago.
Atlas Portland Cement Co., New York.
Burrel Mfg. Co., Bradley, Ill.
Bethlehem Foundry & Machine Co., South Bethlehem, Pa.
Cement Tile Machinery Co., Waterloo, Ia.
Cement Era, Chicago.
Chicago Architectural Photographing Co., Chicago.
Chicago Builders' Specialties Co., Chicago.
Chicago Portland Cement Co., Chicago.
Myron C. Clark Publishing Co., Chicago.
Cleveland-Akron Bag Co., Chicago.
Concrete Publishing Co., Detroit, Mich.
Concrete Stone & Sand Co., Youngstown.
Condron & Sinks Co., Chicago.
Conrad Stone Co., Conrad, Ind.
Continental Car & Equipment Co., Louisville, Ky.
Cropp, A. J.
Dykema Co., Grand Rapids, Mich.
Decorators' Supply Co., Chicago.
DeSmet, Geo., Chamber of Commerce, Chicago.
Economic Engineering & Contracting Co., Chicago.
Engineering News Pub. Co., New York.
Engineering Record (McGraw Pub. Co.) New York City
Expanded Metal & Corrugated Bar Co., St. Louis, Mo.;
Francis Publishing Co., Chicago, Ill.
Gross & Treadway, 928 Stock Exchange, Chicago.
Garden City Sand Co., 1201 Security Building, Chicago.
General Fireproofing Co., 115 Adams St., Chicago; Youngstown, Ohio.
General Electric Co., Schenectady, N. Y.
Robert W. Hunt & Co., Chicago.
Ideal Motor Co., Lansing, Mich.
Inland Steel Co., Chicago.
Inman Concrete Building Block Machine Co., Beloit, Wis.
Ironite Co., Chicago.
Janesville Cement Shingle Co., Janesville,
Arthur Koppel Co., Chicago.
Knickerbocker Co., Jackson, Mich.
Theo. F. Koch & Co., Chicago.
Kern, S. L., Charles City, Ia.
Lansing Wheelbarrow Co., Lansing, Mich.
McKelvey Machinery Co., Chicago.
McIlroy Belting & Hose Co., Chicago.
Monolith Steel Co., Inc., Washington.
Marquette Cement Mfg. Co., Chicago.
Mescham & Wright Co., Chicago.
Municipal Engineering, Indianapolis, Ind.
Mobile Portland Cement Co., Chicago.
Multiplex Concrete Machine Co., Toledo, O.
New Enterprise Concrete Machinery Co., Chicago.
Newaygo Portland Cement Co., Grand Rapids, Mich.
Northwestern Expanded Metal Co., Chicago.
Nebraska Reinforcing Co., Omaha, Nebr.
Peninsular Portland Cement Co., Jackson, Mich.
Porter & Taylor Co. (Inland Architect), Chicago.
Sandusky Portland Cement Co., Sandusky.
St. Louis Portland Cement Co., St. Louis.
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BASCULE BRIDGE.

New Orleans, La., Nov. 21st, 1907.

Pursuant to ordinance No. 4551 and 5832 N. C. S., sealed proposals will be received at the office of the Comptroller in the City of New Orleans until the hour of 1 p. m., Thursday, January 2d, 1908, for the erection of a Bascule Trunion Bridge over the Bayou St. John at the intersection of Esplanade Avenue, in accordance with plans and specifications on file in the office of the City Engineer. Deposit $1,500.00 with the City Treasurer, and his receipt enclosed with bid, or certified check for said amount. Bond in an amount equal to twenty-five (25) per cent of the contract price.

The City Engineer will furnish bidders with a blank form of proposal; no proposal will be considered unless submitted on such form. Bidders must have paid their City License in order that their bid may be accepted.

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Department of Public Works.
Chicago, Ill., November 23, 1907.

Sealed proposals will be received by the City of Chicago until 11 a. m., Saturday, December 7, 1907, at room 224 City Hall, for furnishing and delivering to the City of Chicago at the city pipe yards, approximately fifty-three hundred (5300) tons of cast iron water pipe, from 6 inches to 12 inches in diameter, according to plans and specifications on file in the office of the Department of Public Works of said city, room 317 City Hall.

Proposals must be made out upon blanks furnished at said office, and be addressed to said department, indorsed "Proposals for Cast Iron Water Pipe," and be accompanied with eight thousand ($8,000) dollars in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago and made payable to the order of the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Public Works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names as well as the name of the firm with their address.

JOHN J. HANBERG,
Commissioner of Public Works.
By PAUL REDIESKE,
Deputy Commissioner.

22-2t

PAVING.

CHANGE OF DATE.
Office of the Board of Public Works,
Salt Lake City, Utah, Oct. 12, 1907.

Sealed proposals will be received at this office until 8 oclock p. m., Friday, January 3, 1908, for the work of grading, curbing and paving First South Street, from Second East Street to Thirteenth East Street.

The approximate quantities of work to be done are as follows:

Grading	60,000 cubic yards
Curbing	17,000 linear feet
Asphalt pavement	41,000 square yards

Instruction to bidders, together with specification and forms for contract and bond can be obtained upon application at the office of the Board of Public Works or City Engineer.

The right is reserved to reject any and all bids.

By order of the Board of Public Works.

F. J. LEONARD,
Chairman.

LOUIS C. KELSEY,
City Engineer.

U. S. ENGINEER OFFICE, Portland Oreg., Nov. 20, 1907. Sealed proposals for construction of one stern wheel steamboat will be received here until 11 A. M., Dec 20, 1907, and then publicly opened. Information furnished on application. S. W. Roessler, Lt. Col., Engrs. 21-4t

---

SEALED PROPOSALS will be received at the office of the Light-House Engineer Tompkinsville, New York, until 1 o'clock p. m., Dec. 16, 1907, and then opened, for furnishing two fourth order lanterns for Honolulu Range Light-Stations, Hawaii, in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to the Light-House Engineer, Tompkinsville N. Y. 21-3t

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U. S. ENGINEER OFFICE, Portland, Oreg., Nov. 23, 1907. Sealed proposals for construction of one wooden hull hydraulic dredge will be received here until 11 a. m., Dec. 23, 1907, and then publicly opened. Information furnished on application. S. W. Roessler, Lt. Col., Engrs. 22-3t

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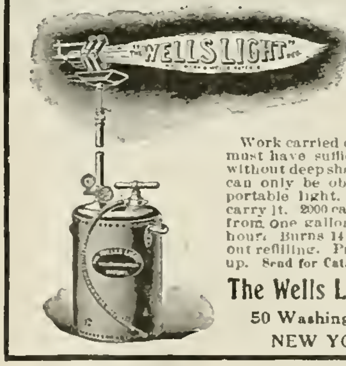

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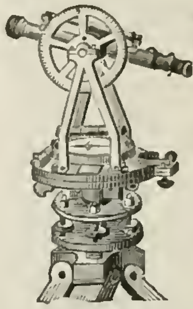

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A Valuable Contribution on Earth Excavation.

In this issue will be found an article by Mr. J. C. Black, to which special attention is called. The principal feature of the article is an ingeniously designed table which receives earth dumped from buckets and discharges it into dump wagons. In work of this kind it is customary to dump direct from the buckets into the wagons, which not only delays the wagon, but results in spilling part of the earth. The lost team time and the shoveling up of the spilled earth are constant sources of expense, which may be done away with by the device described by Mr. Black.

It occurs to us that this same "table" could be used to advantage in loading dump wagons with a steam shovel. A shovel with a large dipper spills so much of its load over the sides of a wagon box that two or three men are kept busy shoveling it up. But that is not the only source of expense. The spilled earth often necessitates the use of a snatch team to pull the loaded wagon away from the point of loading. Moreover, the shock due to the falling of a large mass of earth from a shovel is very hard on any wagon, and frequently causes breakage. This ingenious loading "table" is so counterbalanced that it discharges the earth more gently into the wagon than is possible when loading direct from a steam shovel. The "table" is quite light and could be easily shifted forward by aid of the boom of the shovel.

Another feature brought out by Mr. Black is the loading of buckets by caving earth into them from the face of the cut, thus doing away with a great deal of shoveling. The remarkable effectiveness of this method is well brought out in the table, showing the timing of the filling of 12 buckets of 35 cu. ft. each, which were filled at an average rate of 1 bucket per man in 13½ minutes.

Another feature in this article is the use of a wire rope for swinging the body of a locomotive crane instead of gear wheels. The device really is nothing more than a large "bull wheel" mounted on the frame under the engine and boiler, and a wire rope so arranged as to swing the whole machine, which is supported on balls or rollers, running in a channel. As Mr. Black states, the device is simple and easily repaired in case of breakage.

Machine Mixers for Paving Work.

We describe briefly in another column of this issue the method of using a machine mixer in laying concrete foundation for a pavement. This specific example is not a particularly favorable showing for machine mixing and we will say at once that this has been one of our reasons for presenting it. Concrete which costs 50 cts. a cubic yard in pavement foundation for labor does not demonstrate such a great economy of machine over hand mixing methods as will interest contractors in substituting mechanical mixers for manual labor. On the other hand it is rare that a labor cost as low as 50 cts. per cu. yd. for mixing and placing pavement base is obtained by hand mixing, while for machine mixer work this cost is exceedingly high and results only from inefficient organization such as existed in the work we describe. A few records of machine mixer work elsewhere will demonstrate the truth of this last statement.

In our issue of Octtober, 1906, we described two jobs of pavement foundation work with Foote continuous mixers. In one job a gang of 30 men and 2 to 4 horses hauling Briggs carts averaged 1,200 sq. yds. of 6-in. foundation per 10-hour day. With average wages the same as given in the article mentioned above—$2 per 10-hour day—the labor cost per cubic yard figures out at about 35 cts. per cu. yd. In the second job a gang of 32 men laid 900 sq. yds. of 6-in. foundation or 150 cu. yds. of concrete in 8 hours. This gives a labor cost for mixing and placing of 32 cts. per cu. yd. Gillette in his "Hand Book of Cost Data" records a cost of from 30 to 40 cts. per cu. yd. for 6-in. pavement foundation laid in St. Louis, Mo., using a batch mixer and hauling the concrete in wagons. In this case labor was paid $1.75, teams $4, foreman $3 and engine $5 per 10-hour day. Records on hand show 100 sq. yds. of 6-in. foundation laid per hour on work done in Buffalo, N. Y., with a Chicago Improved Cube mixer equipped with special conveyor for street work. The gang consisted of 17 men and at 20 cts. per hour the labor cost of mixing and placing was 20 cts. per cu. yd. Another record of work in an eastern city using a Ransome batch mixer and two-wheel carts shows 1,080 sq. yds. of 6-in foundation placed per 10-hour day with a gang of 27 men. This gives a cost at wages of $2 per day of 30 cts. per cubic yard.

A continuous and large output is demanded in a mixer for street work; the perfection of the mixing is within limits a minor consideration. This at once admits for consideration types of mixers whose product is classed as unsuitable for reinforced concrete work and also admits of speeding up the output of the better types to a point beyond that at which they turn out their most perfect product. Keeping these facts in mind either of the following two systems of work may be employed: (1) Traction plants which travel with the work and deposit the concrete in place, or so nearly in place that little shoveling is necessary; (2) Portable plants which are set up at wide intervals along the work and which discharge the concrete into carts or dump wagons which distribute it to the work.

The secret of economic work with plants of the class cited first is the distribution of the stock piles so as practically to eliminate haulage from stock pile to mixer. The mixer backs away from the work, its discharge end being toward the work and its charging end away from it. Then deposit the materials so as to form a continuous stock pile along the center of the street; the mixer, moving backward from the completed foundation, keeps close to the materials and if the latter are uniformly distributed in the pile the great bulk of the charging is done by shoveling direct into the charging bucket. The point to be watched here is that the shovelers do not have to carry the materials; separate stock piles within moderate hauling distance by which barrows are a far more economic arrangement than a continuous pile so ir-

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regularly distributed that much of the material has to be carried even a few paces in shovels.

Economic work with plants of the second class depends upon efficient and adequate means of hauling the mixed concrete to the work. The plant should not be shifted oftener than once in 1,000 to 2,000 ft., or, say, two city blocks. This does away with the possibility of wheelbarrow haulage; large capacity hand or horse carts must be employed. With 5 cu. ft. hand carts, such as the Ransome cart, a haul of 500 ft. each way from the mixer is possible and with horse carts, such as the Briggs, this economic distance is increased to 1,000 ft. each way from the mixer. This mixer must be close to the stock pile and it will pay to make use of improved charging devices. A 6-in. foundation for 2,000 ft. of 30-ft. street calls for 667 cu. yds. of concrete and if both sides are curbed at the same time 100 cu. yds. more are added, or 767 cu. yds. in all; where intersecting streets are to be paved in both directions from the mixer plant these amounts are doubled. A very small saving per cubic yard due to mechanical handling of the materials to the mixer amounts to the interest on a considerable investment in such plant. A point that should not be forgotten is that carts such as those named above spread the concrete in dumping so that little or no shoveling is required.

According to a report of the U. S. Consul at Athens, the system generally in use for road laying in Greece is a layer of an average depth of about 6 ins. of rough cobbles, with uneven edges of a diameter of about 1 to 2 ins., covered with a layer of sand of a depth of 1 1-3 to 2 2-3 ins., rolled by a steam roller. The preference is given to the latter system on account of its cheapness, the cost per square meter (1 square meter or centare=1.196 sq. yds) being 5 to 6 drachmas (5.45 drachmas=$1), except in the Thessalian district, where, owing to the scarcity of stone, the cost amounts to 10 drachmas per square meter. Lately some of the streets and squares of Athens and Piræus, covering an area of about 150,000 square meters, have been laid with artificial asphalt at a cost of about 15 francs (1 franc=19.3 cents) per square meter. This work has been done by foreign contractors. The seaside walk of Piræus, representing an area of 20,000 square meters (about 8 square miles), is being laid with Vesuvius lava flags at a cost of 13 drachmas per square meter.

Unofficial figures compiled by experts in the iron ore and coal trade on the Great Lakes show that the movement for the season of 1907 will have been the greatest in the history of the lakes. This year the amount of iron ore brought down the lakes doubtless will total about 41,500,000 tons.

Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Method of Mixing and Placing Concrete for a Tunnel Lining.

The tunnel known as the Burton tunnel is located on the Jasper-French Lick extension of the Southern Ry., and about 4 miles from French Lick, Ind. It is a single track tunnel 2,200 ft. long with 300 ft. at one end on a 4°-30′ curve and 1,900 ft. on tangent. The material penetrated was slate and loose rock, requiring solid timbering throughout. This timbering is shown by Fig. 1, which also shows the concrete lining; the timbering was embedded in the concrete lining. The work of placing the concrete lining was done by the Cullen-Friestedt Co., engineering contractors, of Chicago, Ill., the following methods being employed:

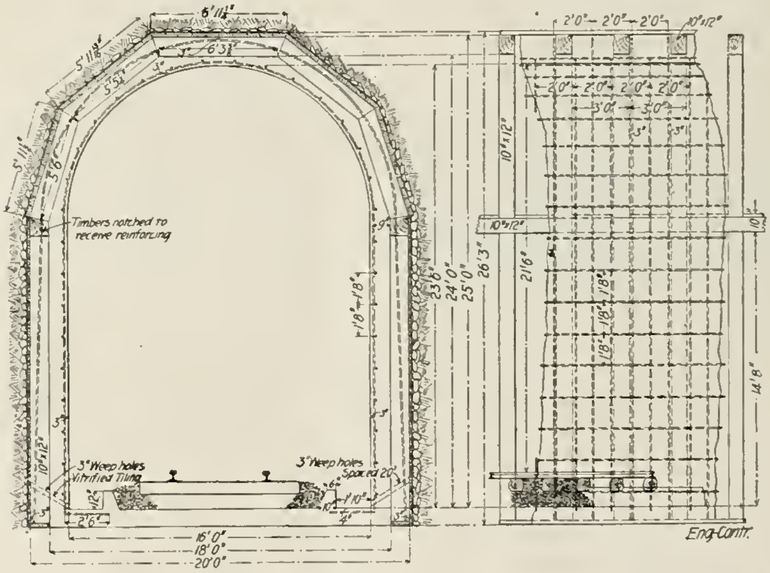

Fig. 1—Section Showing Concrete Lining for Burton Tunnel, Southern Ry.

The original timber lining was composed as follows: Posts 10x12 ins. and spaced 3 ft. apart were set on 3x12-in. sills and carried 10x12 in. wall plates which supported 10x12-in. segmental arch ribs spaced 3 ft. apart. The lagging behind the posts was 3x6-in. stuff and the lagging over the arch ribs was 4x6-in. stuff. The section of the concrete lining is shown by Fig. 1; it required 4.132 cu. yds. of concrete and 161.43 lbs. of reinforcement per lin. ft. The concrete was a 1-2½-5 crushed stone—between 2 in. and ¼ in. size—mixture; it required 1.16 bbls. of cement, 0.52 cu. yds. sand and 0.92 cu. yd. of stone per cubic yard of concrete. The amount of reinforcement per cubic yard of concrete was 39.1 lbs.

All the concrete was mixed and handled from one end of the tunnel. The mixing plant was located in the approach cut at one end. A standard gage main track run through the cut. About 20 ft. in the clear to one side of this track a trestle 500 ft. long was built, carrying an 18-ft. gage derrick track and a narrow gage 3 cu. yd. dump car track. A stiff leg derrick operating a 1 cu. yd. orange peel or a 1½ cu. yd. clam shell Hayward bucket was mounted on a carriage traveling on the 18-ft. gage track. The side of the trestle nearest the railway track was sheeted vertically and the space between this sheeting and the track was floored over at track level for stock piles. Near the end of the trestle toward the tunnel and on the same side of the track was the mixer plant. This consisted of two 85 cu. yd. bins, one for sand and one for stone, carried by a tower so that their bottoms were 25 ft. above track level. Below the bins was a charging platform pierced by a measuring hopper. Below the measuring hopper was a 1½ cu. yd. cubical mixer and below the mixer was a 3-ft. gage track for 1½ cu. yd. Koppel side dump cars. To the rear of the tower at ground level there was a 20-cu. yd. sand bin and a 20-cu. yd. stone bin set side by side with a continuous bucket elevator leading from each to the corresponding bin on the tower. The cement house was located directly across the railway track from the tower. At the side of the cement house nearest the track there was an inclined bag elevator leading up to a bridge spanning the railway track at the level of the charging floor of the mixer plant. On this bridge ran a car for carrying bags of cement. The plant as described is shown by Figs. 2 and 3.

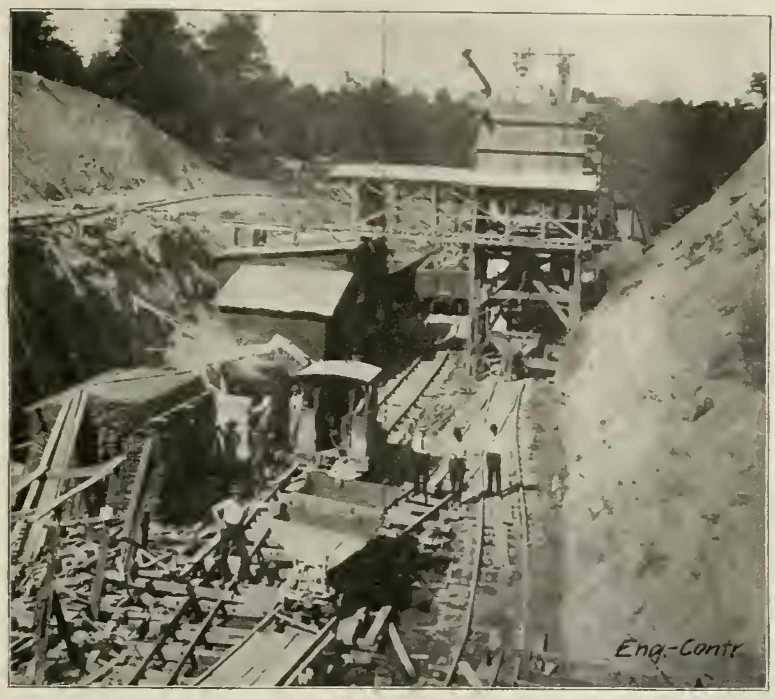

Fig. 2—View of Mixer Plant, Showing Car Tracks into Tunnel.

In operation the derrick unloaded the stone and sand cars by means of the Hayward buckets either into the bins at the feet of the bucket elevators or onto stock piles on the flooring beside the trestle. When put into stock piles the materials had to be reloaded by derrick into the 3 cu. yd. cars on the trestle narrow-gage track and carried by these cars to the elevator boots. The sand and stone were chuted from the tower bins directly into the charging hopper below. Here the cement bags, brought across the bridge on the car into which they were loaded directly by the bag elevator, were opened and the cement added to the sand and stone. The charge was then dropped into the mixer and from the mixer the batch dropped into the Koppel concrete cars.

In the tunnel a traveling platform was constructed on two standard gage flat cars so coupled that a platform 100 ft. long and slightly narrower than the clear space between side wall forms was obtained. Connecting the end of the platform toward the mixing plant was a rampe or inclined platform mounted on wheels. The Koppel car tracks from the mixer were carried up the incline and the full length of the level platform. The cars were hauled to the foot of the incline by a light locomotive. A cable was then hooked to them; this cable was run through a block on the level platform its free end coming back to the locomotive which thus pulled the cars up the incline by moving back toward the mixer. On the level platform the cars were pushed by hand and dumped on the floor, whence the concrete was shoveled into the forms.

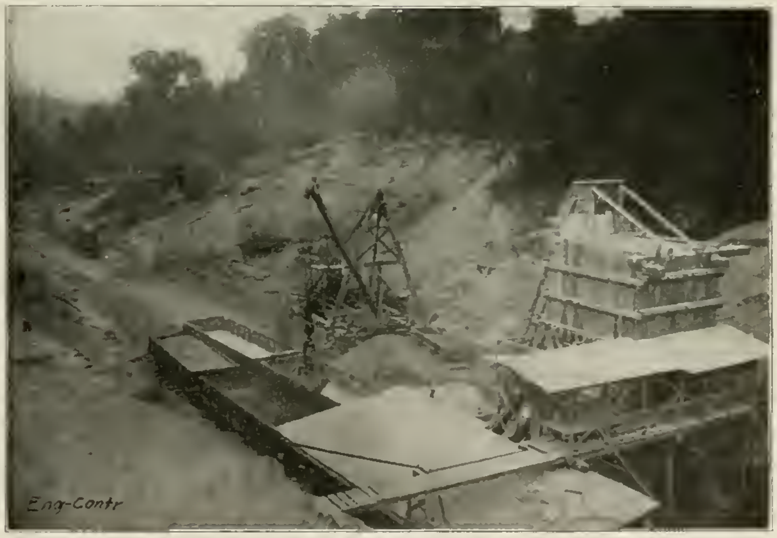

Fig. 3—View of Mixer Plant, Showing Method of Unloading Materials.

The platform construction deserves mention in the particular that it provided for adjusting the platform vertically. At each corner of the car a vertical post some 7 or 8 ft. high was set up. The side stringers of the platform carried two vertical posts at each end; these two posts were spaced just far enough apart to slide over the corner post, one on each side of it. A block at the top of the corner posts with the hoist line connected to the bottoms of the platform posts and the lead line going to a winch head thus made it possible to lift the platform any distance within the height of the vertical post guide and hold it there by blocking under the posts. The arrangement is shown roughly by the sketch, Fig. 4. There was block and tackle for each corner post and a winch at each end of the car. The vertical movement of the platform was between 6 and 7 ft.

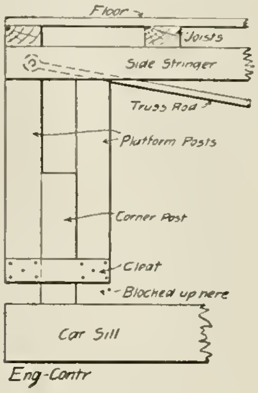

Fig. 4.—Sketch Showing Platform Support

The floor was cemented first, then the sidewalls and finally the roof arch. Floor construction was begun at the portal farthest from the mixing plant. Koppel car tracks were laid through the tunnel and the concrete was dumped from them directly on the ground. The cars were hauled by a light locomotive. As the concreting advanced the dump car track was raised and suspended from timbers across tunnel so that the concrete could be placed under it. As fast as the floor hardened the permanent standard gage track was laid and a temporary third rail placed to give also a dump car track.

When the floor had been finished the

the walls were constructed, using the traveling platform and beginning at the far portal. The wall forms consisted of 4x6-in. studs, spaced 3 ft. apart and carrying 2x12-in. lagging. A 6x6-in. waling outside the studs at about mid height held the studs to the timbering by lag bolts reaching through the wall to the 10x12-in. posts. A strip of plank nailed across wall between stud and post held the form at the top. Wall forms were erected for 100 ft. of wall at a time. These forms required about 45 ft. B. M. of lumber per lineal foot of form on one side or 90 ft. B. M. for both sides. Two sets of side wall forms or 200 ft. of wall forming were built, and used over and over again. The concrete was shoveled into the wall forms from the traveling platform, the lagging being placed a board at a time as the work progressed upward and the platform being elevated as required, its final position being at about springing line level. When 100 ft. of side walls had been completed the traveling platform was moved ahead for another 100-ft. section.

The centers consisted of 6x12-in. ribs, made up of 3x12-in. plank. The feet of the ribs rested on folding wedges on 6x12-in. wall plates, supported by 6x6-in. posts setting close against the finished wall. The ends of the ribs were held from closing in by 6x6-in. walings, one on each side, lag-bolted through the lining to the timbering. The centering required about 315 ft. B. M. of lumber per lineal foot of center. The method of removing the centers was novel. A flat car had erected on it a narrow working platform high enough to reach well up into the arch. Along this platform at the center was erected a sort of "horse," which could be elevated and lowered by jacks. The sketch Fig. 5 shows the arrangement. At each end and at the middle of the platform two guide posts a a were erected and braced upright. Between these guide posts set plunger posts of which were raised and lowered by screw jacks. The three plunger posts carried a longitudinal timber c. The car was run under the ribs of centering to be removed and the timber c raised by working the jacks until it came to close bearing under the ribs d. The railings and the wedges at the foot of the ribs were then removed, leaving the ribs hanging on the timber c. This timber was then jacked down to clear the lining and the ribs rotated horizontally on the point of suspension as a pivot until their ends swung in over the platform. The car was then moved ahead to where the centers were to be used again; the ribs were rotated back to their normal position across tunnel; the timber c was jacked up, and the wedges and railings placed at the first of the ribs.

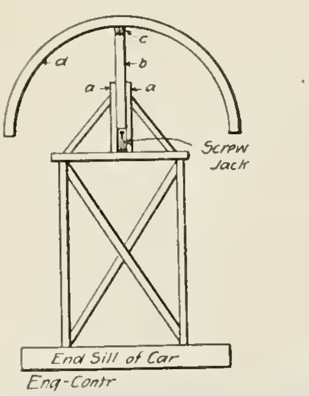

Fig. 5—Sketch Showing Device for Removing Center Ribs.

The concreting on the roof arch was begun at the portal. Two shifts were worked and 42 ft. of arch were concreted each shift.

Method and Cost of Laying Pavement Foundation Using a Machine Mixer.

The foundation was 6 ins. thick for an asphalt pavement and was laid in Chicago, Ill. The concrete used was exceptionally rich for pavement foundation work, it being a 1-3-6 Lehigh Portland cement, broken stone mixture. The mixing was done by machine, a mixer made by the Buffalo Concrete Mixer Co., Buffalo, N. Y., being used. This mixer was equipped with an elevating charging hopper and was operated as a continuous mixer. The mixer was mounted on wheels and was pulled along the center of the street ahead of the work with its discharge end toward the work. Moves of about 25 to 30 ft. were made, the mixer being pulled ahead for this distance each time that the concrete came up to its discharge end. The stock piles were continuous, sand on one side and stone on the other side of the street. Cement was stored in a pile at each end of the block. All materials were wheeled from stock piles to mixer in wheelbarrows. The men wheeling sand and stone loaded their own barrows, wheeled them to the mixer and discharged them directly into the elevating hopper. No runways were used, the barrows being wheeled directly on the ground. The cement was brought in barrows, two or three bags being a load, and dumped alongside a cement box which was loaded close to and at one side of the elevating hopper. A man untied the bags and emptied them into the cement box and another man scooped the cement out of the box in bucket fulls and emptied it over the sand and stone in the elevating hopper. The mixer discharged onto a sheet iron shoveling board, and the concrete was carried in shovels from shoveling board to place, the length of carry being a maximum of 25 to 30 ft. Two men were required to pull down the cone of concrete at the discharge end of the mixer and to keep the stone from separating and rolling down the sides. The gang was organized as follows:

	No. Men.
Loading and wheeling stone	10
Loading and wheeling sand	3 to 4
Loading and wheeling cement	2
Untying and emptying cement bags	1
Charging cement to hopper	1
Operating mixer and hopper	1
Pulling down and tending discharge	2
Carrying concrete in shovels	8
Spreading concrete	2
Tamping concrete	2
Sweeping concrete	1
General laborers	3
Foreman	1
Watchman	1
Timekeeper	1
Total gang	40

This gang averaged 1,000 sq. yds. of 6-in. foundation per 10-hour day; a maximum of 1,400 sq. yds. was laid in a day. We have thus an average of 167 cu. yds. and a maximum of 234 cu. yds. of concrete foundation mixed and placed per 10-hour day. At an average wage of $2 per day the average labor cost of mixing and placing concrete was 48 cts. per cu. yd. or 8 cts. per sq. yd. of 6-in. foundation. It was stated that the gang was larger by three men than was ordinarily used owing to certain extra work being done at the time that the above figures were collected. Taking out three extra men and the timekeeper and watchman we get 34 men actually working in mixing and placing concrete. This reduced gang gives as a labor cost for mixing and placing of about 41 cts. per cu. yd. or 6.8 cts. per sq. yd. of 6-in. foundation. In our issue of Oct. 10, 1906, we gave records of two pieces of pavement foundation work using continuous mixers which show a considerably greater output with a smaller gang.

The U. S. Consul at Manchester, England, in reporting on the roadways of that city states that there are about 30,000 sq. yds. of wood block pavement in Manchester. The wood blocks are mostly Australian karri wood 3 ins. wide, 5 ins. deep, and 9 ins. long, laid on a cement concrete foundation 6 ins. thick. The blocks are paved with a bed of about 1 in. of sand between the block and the concrete foundation, and the joints are flushed with a molten mixture of pitch and creosote oil or tar, to which a little dried sand has been added. Including the concrete foundation, the average cost is about $4.26 per square yard, and its life is from 10 to 15 years.

The municipality of Buenos Aires, Argentine Republic, is calling for bids for the construction of two of the principal lines constituting the proposed system of metropolitan subway electric railways. The bids are to be received before May, 1908.

The full official returns of mining in Great Britain in 1906 give the value of the coal mined during the year as roundly $500,000,000—an increase of $50,000,000 for 1905. This increase was due partly to enlarged output and partly to higher prices.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Method and Cost of Loading Dump Wagons from an Ingeniously Designed Hopper or Table.

BY J. C. BLACK,

The methods and outfit briefly described in this article were those used by the C. J. Cook Company of Portland, Ore., in making the excavation for a business block in that city. Although not involving any exceedingly novel features (unless the dumping table, which will be described later, be considered as such) the work showed how a little care as to details of methods and machinery can affect results. For much of my information I am indebted to Mr. Cook personally.

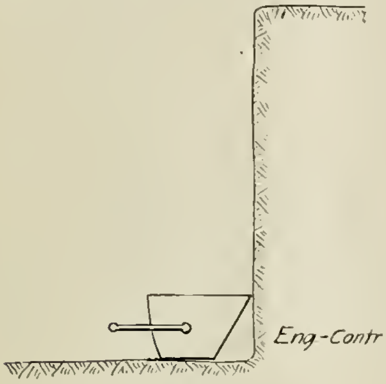

Fig. 1.

The property was a corner lot 100 ft. square and nearly level, and had been occupied by some frame buildings at least one of which had a cellar and stone foundation. About 8,000 cu. yds. of material were handled, the average total depth being about 20 ft. Almost the entire excavtion was a mixture of yellow clay and sand with a small amount of loam. Excavation was begun at the inner corner of the area and was rapidly carried to full depth at that place, thus affording a steep bank against which to work. A locomotive crane lifted the material from the pit in buckets, and dumped it on a table or tipple from which it was loaded into wagons.

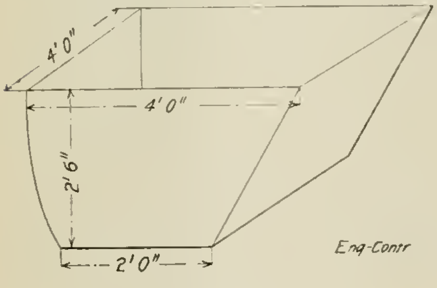

Fig. 2.

A bucket to be filled was placed against the face of the bank, as shown in the sketch, Fig 1, and was loaded partly by shovels, partly by material picked from the face so as to fall into the bucket, and partly by slabs or spalls of earth pried from the top of the bank with a crowbar. This last method appeared to be exceedingly effective, for the earth broke off easily and one man with a bar at the top of the bank could loosen large pieces with comparatively little effort. Sometimes enough earth to fill a bucket would fall at once, while that which fell outside the buckets was in a condition to be easily handled by shovels. It is probable that this method of prying from the top of bank, would prove uneconomical for some classes of material, but in this material it worked well. Data as to loading of buckets are given in table.

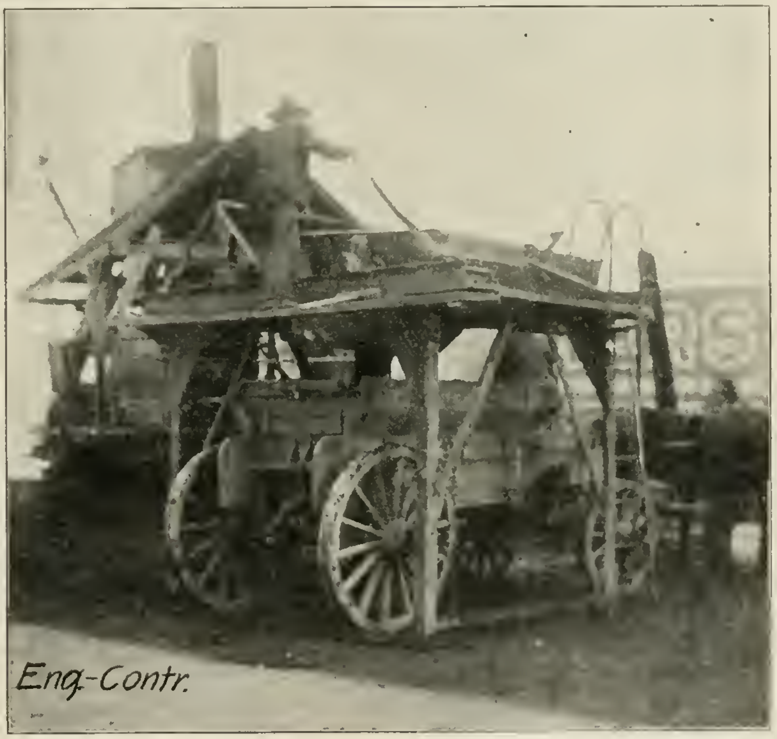

Fig. 3—View of Dumping Table, Showing Method of Loading Carts.

The locomotive crane consisted of a 35-H.P hoisting engine and a wooden derrick frame mounted on a timber sledge. The maximum reach of boom from center of rotation was 30 ft., but, by lowering a bucket almost to the ground and then having it set swinging by the men in the pit, it was possible to drop it some 20 ft. beyond the end of the boom, thus affording a maximum working range of 80 ft. from point of loading to dump. Signals to the engineman were given by whistles. The engine and derrick rotated together on a circular base of 11 ft. diameter equipped with roller bearings, the power for rotation being transmitted through two short cables wound upon the base, which was composed of several cast sections and contained two parallel grooves on its circumference in which ran the cables. The cables, one for each direction of rotation, were operated by small drums, and passed down through the floor and over pulleys which brought them into a position tangential to the circular base so that one could wind in each groove. The end of each cable was fastened in the groove in which it ran. A compensating pulley, operated by a spring, was introduced to take up any slack which might arise from rocking of the derrick or other cause. It will be observed that the arc through which it is possible to turn the derrick is somewhat less than 360°.

With this system of swinging the derrick, delays from accident are reduced to a minimum, as the cable which constitutes practically the only breakable part may be easily and quickly repaired or replaced. This should prove an especial advantage over the somewhat more familiar type of rack and pinion gear, when the machinery is being operated in localities where new parts or heavy repair work are difficult to obtain.

When necessary to remove the crane to

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*616 Bixel St., Los Angeles, Cal.

a new position on the work, a cable was made fast to something which would serve as an anchor and it was made to move itself. Rollers were generally used under the sledge. An hour to an hour and a half was the time consumed in moving. Axles on which could be placed a pair of rear wagon wheels were fitted to the sledge near one end, and at the other was a place for the forward truck of a wagon, thus making transportation from one piece of work to another a very easy matter. The outfit was constructed in Portland, the details being after Mr. Cook's own design.

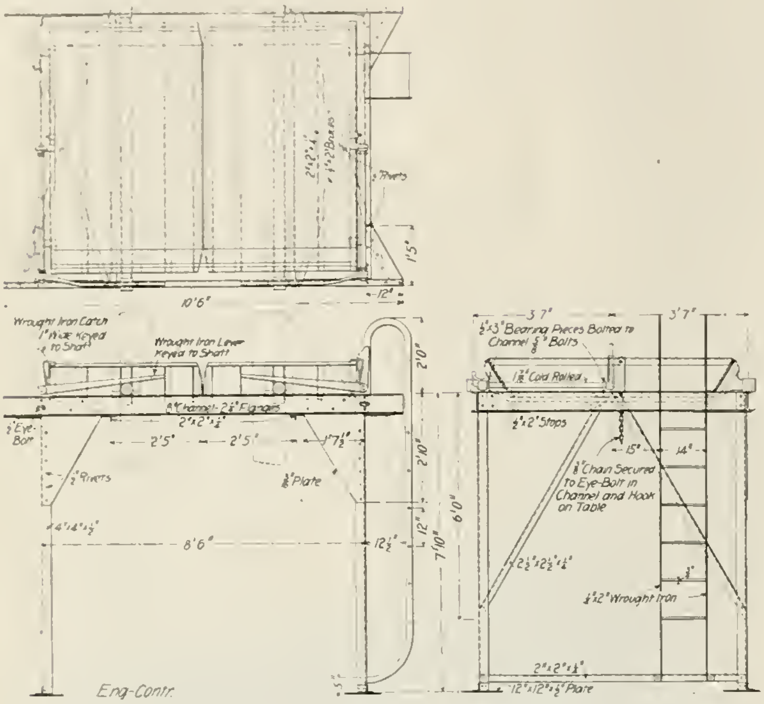

Fig. 4—Plan, Front Elevation and Side Elevation of Dumping Table.

The buckets of which there were five were also made in Portland their shape and dimensions being roughly shown in sketch Fig 2. The nominal capacity was 35 cu. ft. each.

They were dumped by tilting; the catch which held them upright, being released by the man at dumping table. This table, or tipple, was to the writer the most interesting feature of the plant. It consisted essentially of a steel frame supporting two trays under which the wagons to be loaded were driven. The trays are each about 1 ft. deep, 4 ft. wide and 6 ft. long, and when closed, met at the center forming one large tray. In dumping, each tray rotated about an axis of its own near its center, the weight of the earth causing it to dump automatically when released, and the position of its own center of gravity making it automatically return to a horizontal position after having emptied its contents. Its effect was to "trim" the load so that little or no work was required to spread it on the wagons, while the amount spilled was negligible.

It will be seen at once that the table affords a storing place for materials, and thus reduces the lost time due to irregularity in arrival of wagons. Usually only one bucket of earth was placed upon the table at a time. Fig. 3 shows the table an instant after dumping. The right hand tray has returned to a horizintal position, but the left is still inclined. The levers on which the dumpman's hands are resting are those for locking the trays in a horizontal position.

A record of wagons was kept by the dumpman with pegs on a tally board mounted on the table but not shown in the picture. Of course this loader was not so near perfection but that it was occasionally necessary to clean up around it, especially as it was a busy street. However, it reduced work of that nature to a minimum. When necessary to shift the position of the table, a timber yoke was fastened to the frame by chains, and the whole thing was lifted bodily and swung to its new location by the derrick. Figs. 4 and 5 show details of design. The writer is indebted for the details to Mr. Corbett of the Willamette Iron & Steel Works, who were the builders of the greater part of the plant.

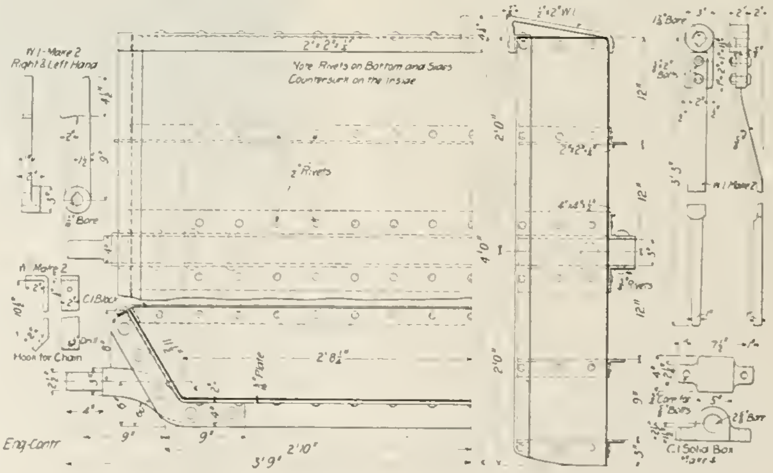

Fig. 5—Details of Design of Dumping Table.

Light for the night crew was supplied by three clusters of six 32-c.p. incandescents each, backed by reflectors.

Studebaker dump wagons were used, and, by an extension to the top, they were made to hold 2½ cu. yds. each when level full; which shows that two buckets of material were required per load.

The cost of the plant was approximately as follows:

Locomotive crane (including cable)	$4,500.00
Five buckets at $145	725.00
Loading table	500.00
Total (exclusive of small tools)	$5,725.00

Two crews of equal size were employed most of the time, a total daily force being about as shown in the table. The rates of wages are assumed, and would, of course, vary from time to time, and with location.

Two foremen, at $4.00 per day	$ 8.00
Two engineers at $4.00 per day	8.00
Two firemen at $2.50 per day	5.00
Two signalmen at $2.50 per day	5.00
Two hook tenders at $1.75 per day	3.50
Two dumpmen at $1.75 per day	3.50
Thirty laborers at $1.75 per day	52.00
Total daily wages	$85.50

One man sometimes acted as both signalman and hook tender. Assuming other daily expenses, we have:

Labor	$85.50
Fuel, oil and supplies	5.00
Repairs	5.00
Total	$97.50

The average daily output, as stated by Mr. Cook, was 500 cu. yds., for the two crews, which gives a cost per cu. yd. of nearly 20 cts., loaded on the wagons. Each of the 30 laborers, therefore, averaged nearly 17 cu. yds. per day.

The following details are from data obtained by personal observation at various times:

LOADING BUCKETS.

(All Buckets Filled Heaping—35 Cu. Ft. Struck Measure.)

Bucket No.	Labor.	Time. Min.	Sec.
1	3 men shoveling	3	50
2	4 men shoveling	4	45
3	3 men shoveling	5	10
4	3 men shoveling and picking	5	30
5	2 men shoveling, 1 man picking	4	55
6	3 men shoveling	3	45
7	2 men shoveling and picking, 1 man barring from top	3	15
8	2 men shoveling, 1 man picking from face into bucket	4	00
9	1 man shoveling, 2 men picking from face into bucket		
10	2 men shoveling, 1 man picking and barring	3	45
11	1 man shoveling, 1 man picking into bucket, 1 man barring	3	50
12	2 men shoveling, 1 man barring down from top	5	00
	Total, 28 men shoveling, 10 men picking and barring	50	53
	Average 2⅓ men shoveling, 5-6 men picking and barring	4	15

This is equivalent to a bucket of earth loosened and loaded by one man in 13½ minutes.

Data on time consumed in handling buckets are as follows:

	Seconds of time. Lowering empty and lifting loaded bucket.	Rotation of crane with loaded bucket.	Dumping.	Rotation of crane with empty bucket.	Total time for handlin' one bucket. Min.	Sec.	Arc turned.
No. 1	43	15	13	12	1	23	180°
2	45	17	8	10	1	20	180
3	60	20	10	15	1	45	270
4	38	18	14	18	1	28	270
5	37	18	12	10	1	17	200
6	50	18	8	12	1	28	200
7	62	15	10	10	1	37	270
8	43	17	15	10	1	25	270
9	44	16	10	15	1	25	240
10	45	15	20	11	1	31	240
11	42	18	19	18	1	37	270
11 buckets handled	509	187	139	141	16	16	200
Average	46	17	13	13	1	29	200

This indicates that the time required to handle one bucket is approximately 1½ minutes, so that barring delays 40 buckets or 52 cu. yds. would be the maximum hourly capacity of the crane.

The owners of the plant are much pleased with its operation and are going to give it a trial with three eight-hour shifts.

It will be seen that the plant is of low first cost, is adapted to the handling of a variety of materials, is economical of time, and affords a great saving in the wear and tear on teams and wagons which results from hauling out of an excavation. This last point is considered by Mr. Cook to be the greatest advantage of the system.

A Post hole Digger Adapted to Digging Holes for Large Poles.

There are numerous styles of post hole augers and diggers, but the most of them will only dig one size hole. In other words, these patented diggers are made in sizes from 3 or 4 ins. up to 14 or 16 ins., and a different size digger must be used for each size of hole wanted. With the Butcher post hole digger this difficulty has been overcome, and a one size digger will dig any diameter hole from 6 ins. up. The only limit being the depth, a longer handle being needed for deep holes.

The digger is illustrated in the four figures. By a simple contrivance the digger is both a digging spade and a spoon. The blade is 7 ins. long and 6 ins. wide, being deeply turned on the sides, so it will hold a considerable amount of dirt. Two catches on the handle control the movement of the digger. Fig. 1 shows it as a digger, and Fig. 2 as a spoon. In digging small holes, the man using the digger first stands on one side of the hole and then on the other This allows of the hole being dug the smallest possible size. This is illustrated in Figs. 3 and 4. For shallow holes, unless the ground is very hard, no other tool is needed to loosen the dirt.

Besides digging small holes as cheaply as other augers, the Butcher digger is well adapted to digging holes 3 or 4 ft. in diameter and 5 or 6 ft. deep, for large telegraph and other poles. Ordinarily for this work the workman is furnished a digging bar, a spading shovel and a spoon. For these holes a bar is needed, but the manufacturers of the Butcher digger make a hollow bar for this purpose, which allows of quicker work than the solid bar. Their digger, as previously stated, takes the place of the spading shovel and spoon. The digger is far superior to the spoon, for it is not only stronger, but also of greater capacity. This, coupled with the fact that the man digging the hole does not have to be changing from the shovel to the spoon continually, means that such holes will be dug very much cheaper with the Butcher digger, than with the tools now in prevalent use.

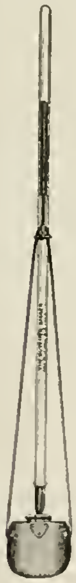

Fig. 1.

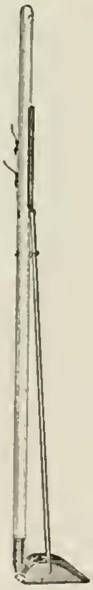

Fig. 2.

Where holes are made larger at the bottom than at the top, to be filled in with concrete, this digger is particularly well adapted to the work. For these reasons, besides being a labor saver, this digger also saves the cost and caring for an extra tool, for digging telegraph, telephone and trolley pole holes of large sizes.

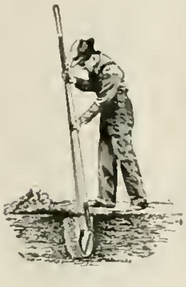

Fig. 3.

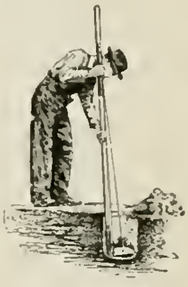

Fig. 4.

This digger is manufactured by the Laramy-Howlett Co., Standish street, Cambridge, Mass.

The total mileage of steam railways in Greece is 865 miles; the total capitalization is $42,215,209.

During the year 1906 a total of 3,975 vessels of a total tonnage of 18,809,169 tons gross passed through the Suez Canal.

During the past year the death rate in British coal mines was 1.4 per 1,000 employes. In 1856 the rate was 5 per 1,000 employes. The reduced percentage is ascribed to the use of safety devices in the mines.

The Traffic Commission of the municipality of Berlin has decided to build an underground railroad running northwest and southeast through the heart of the city, from Charlottenburg to Rixdorf. The cost of the new line is estimated at $15,000,000. It is an addition to the subway to run north and south, plans for which are now under preparation. Berlin is also to have five new surface lines.

The mayor of a small city in Illinois was much in favor of installing water works and a sewer system. The citizens, however, objected to the improvements, because they were perfectly satisfied with their cisterns and believed they would not leak. The mayor was equally positive that the cesspools did leak into and contaminated the cisterns, so one night he sent a man around and had him dump a gallon of kerosene into every cesspool. The next morning the citizens were wondering how kerosense got into their cisterns.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Mining and Transporting Kaolin by Hydraulic Process.*

BY ALBERT R. LEDOUX.

I am indebted to the Kaolin Co. of West Cornwall, Conn., and particularly to its engineer, Mr. M. Wanner, for permission to make public, through the Transactions of the American Institute of Mining Engineers, the interesting results of his experiments, having in view the winning of kaolin from deep deposits without shaft-sinking or removing of the overburden. So far as I am aware, nothing like it has been accomplished heretofore, although it reminds one of the methods successfully employed in Louisiana for the winning of sulphur from deep beds by the sinking of pipes one within another, injecting superheated steam under pressure through one pipe, the heat of the steam liquefying the sulphur and the pressure forcing it up through the other pipe to bins at the surface.

The kaolin deposit at West Cornwall is an alteration *in situ*—that is, it is not sedimentary. A series of clay veins dipping about 50 degrees from the vertical, lie between a foot-wall of limonite and a hanging-wall of gneiss and hornblende schist. The clay-veins alternate with veins or seams of more or less broken quartz, and unaltered feldspar. The deposit, which occurs at a point about 600 ft. above the Housatonic river, was opened five years ago, and about 5,000 tons of a superior grade of washed kaolin has been extracted from open pits and sold. It soon became evident that this mode of extracting the product would prove unremunerative, by reason of the dip of the vein and the intercalary strata and lenses of quartz, and a more satisfactory method of working the deposit was sought. It is well understood, that, in the preparation of all clays for market, especially residuary kaolin, the most important as well as the most difficult step is the washing of the crude product. The difficulties increase with the percentage of foreign matter, especially quartz and mica, contained in the product, hence a system of working a clay-deposit by which it would be possible to obtain the crude material from great depths without removing the overburden (or, in the case of veins, without resorting to shafts, drifts and other underground workings requiring timbering), and, at the same time, minimize the raising of waste material with the marketable product, would be of great advantage.

Proceeding on the logic of these observations, Mr. Wanner, the engineer temporarily in charge of the operations at the mines, conceived the scheme to disintegrate the kaolin *in situ* by means of jets of water under sufficient pressure and floating the resultant product on the surface. This product is technically known in the pottery trade as "slip." To accomplish this result holes are drilled through the overlying gneiss, a pipe of 4-in. internal diameter is inserted into the bore and driven into the clay body to within a few feet of the foot-wall. The wells in operation are from 50 to 198 ft. deep. Into this 4-in. pipe or "casing" an interior pipe is inserted of 2-in. external diameter, leaving an annular space of 1 in. for the flow of the slip. The lower end of the internal pipe is provided with a mouthpiece with several nozzle-like openings for the exit of the water; the mouthpiece rests on the clay body, and the interior pipe sinks gradually as the clay is removed until it rests on the foot-wall of the vein. For the operation of these "hydraulics" a head of water equivalent to a pressure of from 40 to 60 lbs. per sq. in. is required, according to the nature of the vein-matter.

Residuary kaolin slacks more or less readily, according to the amount of sand and mica mixed with it. In the case in point it is found that a pressure of 40 lbs. is amply sufficient to cause the disintegration, the vein-matter contains 20 per cent, and the slip, discharged by the hydraulics, from 60 to 75 per cent of pure kaolin. The purity of the discharged slip is inversely proportional to the velocity of the overflow.

Observations made during the past summer's work have shown that the overflow contains from 5 to 10 per cent of solid matter. A discharge of 100 gals. per min. through the annular space of 9.42 sq. ins. from a depth of 127 ft. yielded 5 per cent of solid matter, of which 75 per cent was pure kaolin, while a discharge of 200 gals. per min. through the same orifice from the same depth, gave a slip containing 10 per cent of solid matter but only 54 per cent of pure kaolin, the rest being finely divided quartz and mica.

One of the factors directly responsible for the purity of the slip as well as for the facility of the separation or washing of the product is the accumulation of the waste material in the cavities caused by the withdrawal of the product through which the slip has to pass to arrive at the lower orifice of the casing. The passage of the slip through this mass, which consists principally of a breccia of quartz, acts as a scouring medium, effectively helps in the separation of the clay particles from associated fine scales of mica, and renders easy its final division by subsidence.

In addition to the lessening of the cost of extraction, the method described has effectually solved the transportation of the produce to the railroad. Heretofore, the kaolin washed and dried at the mines was carted by teams over a difficult mountain road to West Cornwall, 4 miles distant. The fuel for the whole plant had to be hauled up the mountain the same distance. With slip issuing from the hydraulics of only 10 per cent of solid matter and sufficient fineness to pass through 100-mesh screens, the conveyance of the product through a pipe-line to the Housatonic valley offers no difficulty, and the company now contemplates the erection of a new washing plant adjacent to the river and railroad.

The highway system of France consists of a great network of national routes, connecting the larger cities, and systems of local roads in every department connecting the small towns and villages. The building and maintenance of both national and local roads are directed by a government administrative bureau, the lowest grade of which is the cantonnier, who has from 4 to 7 kilometers of highway under his immediate supervision.

The cantonnier lives on the line of his jurisdiction, and is responsible for the maintenance of his section of road at all times. He keeps the ditches open, carefully fills holes and ruts with broken stone when such are discovered, removes dust and deposits of sand and earth after heavy rains, trims the trees and bushes, and when citizens furnish labor in payment of their road tax directs their work. When ordinary work is impossible the cantonnier breaks stone and transports it to points where it is likely to be needed. He is expected to bring to the attention of his chief any condition requiring special attention, and is the man on the spot in every emergency. Each cantonnier has a book, and in this book the chief cantonnier, who passes over the road at least once a week, notes his instructions and checks up the work accomplished during the preceding interval. The conductors go over the line at regular intervals also and direct the chief cantonniers, and all reports are transmitted to the central authorities, who thus follow the prevailing conditions on every foot of national highway in France. Each year the conductors prepare estimates of necessary expenses for the following year, itemizing them under the heads of maintenance, heavy repairs, and new work, and the parliamentary appropriations are based upon these careful local calculations.

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*A paper read before the American Institute of Mining Engineers.

Methods and Costs; Some Old; Some New.

Sinking a Well in Moist Sand.—A well 7 ft. in diameter was excavated through moist sand, without sheathing, in the following manner: After the excavation had been carried down a few feet a wooden templet was placed and an 8-in. brick lining built to the surface. The excavation was then continued by cutting under the templet, the brick-laying being continued at the top. In this way the well was carried down to a depth of 60 ft. There was no signs of crowding or pressure and the ring sunk readily, the excavated material taking a slope of about 1½ to 1.

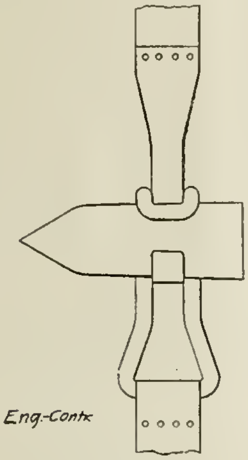

Fig. 1.

Making a Foundation on a Bed of Silt.—In the construction of an 80-ft. long wooden box culvert under a dike it was found that the foundation material consisted of about 2 ft. of ooze, stumps, brush, etc., beneath which was 4 to 6 ft. of silt. It was decided to lay the culvert on the bed of silt without disturbing it any more than was necessary. Accordingly all the ooze, slime, logs and decayed matter were dug out and a bed of clay, 2 ft. thick, was laid down in layers a few inches in thickness, carefully leveled and well tamped and rammed down. This layer of clay extended the full 80 ft. of the length of the projected culvert. On top of the layer was placed rows of brush extending across the foundation with butts toward the end, all standing branches being nicked so as to make them lie straight. Another layer of brush was then laid, somewhat like thatching, the operation being continued until the clay layer was thus covered for a length of 60 ft. Another layer of clay, 1½ to 2 ft. thick, was then placed over the whole foundation and thoroughly compacted by horses and leveled off. On top of this second layer of clay was placed another thatching of brush similar to the first, except that it was commenced at the opposite end of the foundation and the butts of the brush was reversed. This brush layer also extended over about 60 ft. of the foundation and thus overlapped the first layer. Care was taken that there was always a good layer of clay between the brush layers, so that the brush should nowhere be continuous through the length. On top of the second layer of brush was placed another layer of clay and the operation continued until the proper height was reached.

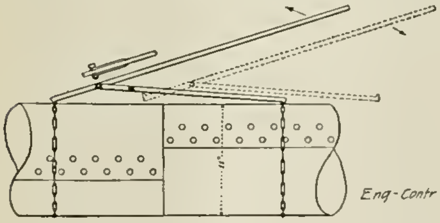

Fig. 2.

Marking Street Intersections.—The names of many of the intersecting streets at Kansas City, are shown by enameled letters set in the cement sidewalks. Regarding this Mr. W. H. Dunn, Superintendent of Parks, writes us as follows: "For a number of years we have incorporated in our cement sidewalk contracts provision for standard blue enameled letters spelling the intersecting street names, to be constructed in the walk as built, and cost of same is made a part of the cost of constructing the sidewalk—in other words, the sidewalk plans call for these street names, and the contractor figures the additional cost of same into his price per square foot for the whole work. We use two names on each corner of the intersection—as you approach the boulevard from a cross street the name of the boulevard is so inserted as to be read as you are approaching the boulevard—and as you are walking along the boulevard the names of the intersecting streets are so placed as to be read as you approach the cross street. These letters are uniformly 6 in. in height and with the exception of the letters W and M are uniformly 4 in. in width, excepting also that the letter I is 2 in. in width. We have found this plan very successful and have had no trouble with the letters in the walk. They need some care and attention in placing and lining up to agree with the grade but are practically indestructible."

Pipe Lines for Hydraulic Mining.—In hydraulic mining in Alaska the water is distributed from the pressure box to the monitors and elevators by means of wrought-iron or more generally, steel-riveted pipe, usually made up in sections 17 to 19 ft. long. Sheet steel is used, from 8 to 16 U. S. standard gage, bent, each plate, 30 or 36 ins. long, being riveted in double rows lengthwise and single on the ends. The sizes used in Alaska vary from 8 to 36 ins. according to Mr. C. W. Purrington in his Bulletin on Gravel and Placer Mining in Alaska, from which the matter in this note has been taken. The pipe is shipped by the manufacturers either made up and riveted ready to be laid with slip joints, or the material is supplied in short plate sections, bent, punched and furnished with necessary rivets, ready to be cold riveted on the ground. Sections of pipe are put together by slipping or by flange or lead joints. If it is advisable to reinforce a slip joint, the device shown in Fig. 1, which can be made quickly in a blacksmith shop, is often used. The sleeve, lugs and keys should be made of soft steel. In laying pipe from the pressure box to the claim the line should be started at the lower end and the joints slipped in down the slope. In cold climates the best practice is to lay the pipe line in a slight lateral curve, so that subsequent contractions of the units may be remedied by pushing the pipe into a more nearly straight line. The pipe should be laid as nearly straight as conditions will allow, and elbows and bends of small radius should be avoided. Various methods of "setting" the pipe are used. In Oregon the device shown in Fig. 2 is used in setting and unsetting pipe. The wrench is made with reversible parts, so that the position of the leverage can be changed for the different operations. Another device sometimes used in British Columbia is shown in Fig. 3. It consists of a square block of timber 3 ft. x 3 ft. x 9 ins., faced with 1-16 in. steel plate, to which is bolted a disk-like wooden plug the diameter of the pipe inside. Two men batter the timber with mallets. Lead joints are seldom necessary in Alaska operations, the almost universal practice being to use slip joints. On steep declivities pipe joints are braced and strengthened by means of lugs and wiring as shown in Fig. 4.

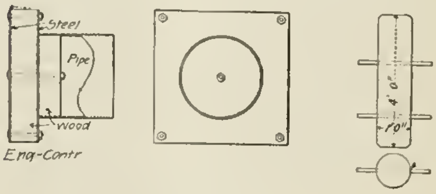

Fig. 3.

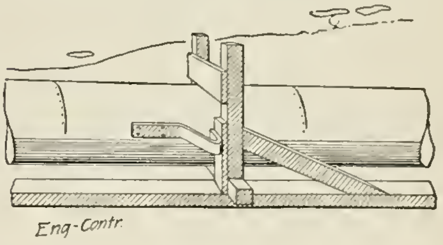

Fig. 4.

The Pavements of Toronto—Excerpts From the City Engineer's Report.

The 1906 annual report of Mr. C. H. Rust, city engineer of Toronto, Canada, contains, as usual, much interesting information. We quote a few of the most interesting facts as to pavements.

The following are the average prices paid for the different classes of pavements laid during the year:

	Per sq. yd.
Asphalt (heavy)	$1.91
Asphalt (light)	1.42
Brick on concrete	2.20
Brick blocks on concrete	2.52
Cedar block	.85
Macadam	.85
Tar macadam	1.50
Bitulithic	2.25

Tar Macadam Pavements.—This year there were two tar macadam pavements constructed, which together amounted to .247 mile, which is a decrease of 1.01 miles or about 80 per cent when compared with the 1.257 miles constructed during 1905; of this mileage .055 mile was constructed under the old specifications and the balance under those revised in 1905.

TABLE SHOWING AMOUNT OF PAVEMENT IN TORONTO, ONT.

Class of Pavement.	Total sq. yds. in city.	Total miles in city.	Square yards laid in 1906.	Year first laid.	Maximum grade of pavement.	Guaranteed period of years.	Maximum cost per sq. yd. 1906	Minimum cost per sq. yd. 1906	Average cost per sq. yd. 1906.	Remarks.
Asphalt	1,115,804	63.71	200,445	1888	% 4.73	10	$2.01	$1.79	$1.91	Heavy.
“							1.64	1.38	1.42	Light.
Brick on concrete	274,570	18.58	20,047	1893	5.50	5	2 42	2.15	2.20	On 4-in. concrete
Brick (blk.)						5	2.60	2.45	2.52	On 6-in. concrete
Brick on broken stone	15,031	.842		1899		5				None laid in 1906
Brick on broken gravel	32,009	2.218		1896		5				“ “ “
†Cedar block				1881	3.78	5				“ “ “
“ “	544,407	40.53	23,601			5			.85	On gravel.
Gravel	75,000	5.83		1880		1				None laid in 1906
*Scoria and granite	83,375	4.817		1884		5				
Macadam	649,027	54.39	23,463		4.20	1			.85	8 ins. in depth.
Tar macadam	76,192	5.70	3,083	1900	3.70	1			1.50	
Bitulithic	88,585	5.98	40,218		10.94	10	2.25	2.25	2 25	

† On concrete.
* Street railway track allowance not included in total mileage.

The large decrease in this year's tar macadam furnishes strong evidence of the growing unpopularity of this class of pavement. This adverse opinion in regard to those works laid under the old specifications is no doubt justified, but with respect to the new class of tar macadam there is good reason for belief that this pavement will be of a durable nature.

As the cost is almost as much as asphalt we have decided to abandon the construction of this pavement for the present.

Bitulithic.—The first bitulithic pavement laid in Toronto was started in November, 1903, but was not completed until the following year. This pavement was very small, being only .063 mile in length, and was merely intended to act as a sample. Since 1903 more bitulithic has been laid; the amount put down during 1904 was 1.528 miles, that laid during 1905 being 1.635 miles, and during 1906 there was a total of 2.759 miles laid. This makes a total at present laid in the city of 5.985 miles of bitulithic. The mileage for 1906 represents a yardage of 40,218 sq. yds.

The above figures show a pronounced yearly increase in this class of pavement.

The bitulithic pavement carries with it a 10-year guarantee, and while it may still be looked upon in the light of an experiment, so far as local knowledge and conditions are concerned, there is every evidence that it will live up to the expectations of the promoters.

The pavement as originally laid consisted of a base of broken stone of such depth that when thoroughly rolled and brought to grade a thickness of 4 ins. was obtained. This base was covered with a wearing surface of broken stone, 2 ins. in thickness, treated with a patent mixture. Recently several pavements have been put down which provide a 4-in. concrete foundation on which is laid the usual 2-in. wearing surface. This latter class may be considered the better when the question of repairs is approached. In a city such as Toronto, where a pavement of any class is apt to be opened at any time and anywhere for repair or installation of gas or water services and private drains, the question of repairs enters very largely into consideration, and it is an established fact that concrete furnished the most easily repaired of all permanent foundations; it is therefore to be advocated that the bitulithic pavement should be laid on a concrete foundation where the nature of the subsoil will permit.

One of the chief advantages claimed for this pavement is that it provides a safer footing on a slope for horses than asphalt, brick, etc. This principle should not be carried to extremes, a 7.5 or 8 per cent grade being about the safe outside limit.

Macadam Pavements.—In comparing the number of works constructed during the year with the number of works constructed in 1905 a large decrease is to be noticed in macadam roads. This is a very satisfactory showing and is largely owing to the low prices of asphalt and to the fact that the citizens are in a position to pay for a permanent roadway and appreciate the benefits to be derived from its construction. There is no doubt that a good roadway in front of property increases the value of the property from 20 to 25 per cent.

The department is using every legitimate means to decrease the mileage of macadam roads, especially in the business part of the city. Macadam roads are the most expensive to maintain and clean, besides being very dusty in dry weather, very dirty in wet weather, and are also very objectionable on account of contributing such a large quantity of dust and dirt to other streets which they intersect.

During the year there were only 1.591 miles of macadam constructed, as compared with 3.373 miles laid in 1905, showing a decrease of more than 50 per cent. I think it is gratifying to be able to note this pronounced decrease in the construction of macadam roads.

One of the objections of this department to this class of road, in addition to the cost of maintaining, is the difficulty of procuring a suitable class of stone at a reasonable cost.

Brick Pavements.—During the year this department only constructed about 1½ miles of brick pavements. It is to be regretted that more miles of this class of pavement are not being laid, but it is very unpopular on account of the noise, and the price exceeds that of asphalt.

Concrete Pavements.—Two concrete pavements were constructed during 1906, one on Rush lane, between Esther and Portland St., and one on Court St. Square, around No. 1 police station. Under such traffic conditions as exist on these thoroughfares, concrete pavements seem to be very satisfactory, being durable, easily cleaned and therefore sanitary, and much cheaper than either brick or asphalt. The construction of this class of pavement, however, is not to be encouraged for streets which are subjected to very heavy traffic.

In 1906 a mileage of .144 mile was constructed as compared with .055 mile in 1905.

Concrete Curbs.—Concrete curbing has entirely superseded stone curbing in the construction of asphalt pavements, 41,073 lin. ft. of combined concrete curbing and gutter and 79,295 lin. ft. of concrete gutter only having been laid during the year 1906. The forecast of last year that 6-in. concrete curbing would be largely used in preference to the 5-in. curbs has been fulfilled. In nearly every case the 6-in. class has been constructed and the more substantial appearance is well worth the slight increase in the cost.

In connection with tar macadam pavements there was constructed during the year 1906 2,389 lin. ft. of combined concrete curbing and gutter such as is used in the construction of asphalt pavements. This form of gutter will very probably entirely replace brick, which was formerly used.

Methods and Cost of Transmission Line Construction for Interurban Electric Railways.*

BY E. P. ROBERTS AND J. C. GILLETTE.

I.

The following data on overhead line construction for interurban electric railways are based on actual practice and on the average costs of a large number of lines in different sections of the United States. The elements of interurban electric railway overhead line construction are: (1) A conductor from which the cars take electrical energy, and (2) the supporting of this conductor, which may be directly by brackets or by cross spans, which in turn are supported by poles. These two methods of construction are termed respectively bracket suspension and cross-suspension. The trolley wire may be supported either directly from insulators carried by the brackets or spans, or by steel cable, which in turn is supported by the brackets or spans. The former is the old and standard method of trolley construction so long used on direct current lines, while the latter is the new "catenary" type of construction. The work for a 600-volt direct current line will be considered first and then the work for a line for higher voltage alternating or direct current motors.

600-VOLT DIRECT CURRENT LINE.

The general character of construction will be wooden poles with either bracket or cross suspension, probably the former, the poles being spaced 90 to 100 ft. For most interurban electric railways, even for light traffic, it is advisable to install two trolley wires, each of which is not less than No. 000 for heavy service, and in many cases No. 0000 is preferable. In cases of very light traffic No. 00 may be advisable, as the necessity for reliability of service is lessened. In most cases there must be such amount of copper, either as trolley or as trolley and feeder wire, as will equal the cross section and weight of two No. 000 wires. It costs about as much to place such copper as feeder and trolley wire as it does if all is in the form of trolley wire, if the saving on siding construction is considered, and it is preferable to place two trolley wires, as this does away with overhead frogs, and in case of the breaking of a trolley wire avoids a tie-up of the road. Trolley wire is hard drawn copper and is generally either figure 8 or grooved. Round wire is somewhat preferable for carshop yards and for sharp curves, such as turning corners on city streets, but the forms above stated are preferable for high speed runs because they give a smoother running surface.

The trolley wire is suspended from the bracket, or cross suspension, by means of a hanger, and such hangers are of several types. The hanger ear, or clip, which holds the trolley wire, should be of ample length, and for figure 8 or grooved wire, usually consists of two jaws clamped together by screws. The stud which supports such jaws passes into, and is supported by, the insulating material of the hanger, which insulating material is in turn supported by a cast iron or brass hanger body, which latter is secured to the bracket or to the cross suspension cable. In the past, troubles have been caused both by the mechanical weakness of the structure, and also by the electrical weakness of the insulating material, especially after exposure to varying temperatures and climatic conditions, but hangers and clips of satisfactory design are now obtainable.

The trolley hanger may be supported by a bracket, or by a cross suspension cable. Steel cable should be not only of sufficient initial strength for the purpose, but also the galvanizing should be carefully inspected in order to assure long life. The bracket consists of steel tubing, angle iron or T-iron, generally painted in order to increase life, as well as to improve the appearance. An over support gives the maximum strength at least cost. In some cases an under support may be preferable, because of allowing less height of pole.

A telephone line is usually provided, and a metallic circuit is necessary. The wires are placed on cross arms or brackets, and with frequent transpositions. The wire for the telephone line is usually No. 10 B. & S. gage copper, if telephone line is more than 50 to 60 miles in length, but on shorter lines it may be high grade iron wire.

Cost Data.—The costs submitted are probable costs between limits, but even though a maximum limit is given, the actual cost may sometimes exceed these figures, depending on local conditions.

Starting from the standpoint of the cheapest practicable construction, we have 30 ft. poles, 90 to 100 ft. spacing, and bracket supports, and with double overhead No. 000 trolley. The cost of such construction will approximate the figures given by Table I.

Table I.—Cost per mile of bracket construction single track 600 V. two No. 000 trolley wires, poles spaced 100 ft.

	From	To
Fifty-three 30-ft. poles in place and framed, poles delivered on cars $4.00-$6.00	$ 325.00	$ 475.00
Fifty-three brackets in place with fittings	180.00	210.00
Ears, hangers, etc., in place	50.00	75.00
Two miles No. 000 trolley with splicers, at 20c-26c.	1,100.00	1,400.00
Erecting same	100.00	150.00
Siding construction pro rated	75.00	100.00
Curve construction 1,500 ft. additional cost	50.00	75.00
Five anchors	8.50	15.00
Two hundred ft. strand for guys	2.25	2.50
Two half anchorages	5.00	10.00
Lags, clamps, etc.	5.00	8.00
Per cent on material for handling	75.00	100.00
	$1,975.75	$2,620.50
Add for lightning arrester.	10.00	20.00
Add for telephone system pro rated	75.00	100.00
	$2,060.75	$2,740.50
If all poles are anchored add	160.00	265.00
If 35-ft. poles are used add (poles $6.00 to $8.50)	130.00	160.00
Total	$2.350.75	$3,165.50

If for any reason, it is decided to use cross suspension instead of bracket construction with the same pole spacing and size of trolley, then the approximate cost will be as given by Table II.

Table II.—Cost per mile of span construction single track 600 V. two No. 000 trolley wires, poles spaced 100 ft.

	From	To
One hundred and six 30-ft. poles in place and framed, poles delivered on cars $4.00-$6.00	$ 650.00	$ 950.00
Ears, hangers, etc., in place	50.00	75.00
Span wire erected	60.00	85.00
Two miles No. 000 trolley at 20c-26c	1,100.00	1,400.00
Erecting same	100.00	150.00
Siding construction, pro rated	75.00	100.00
Curve construction, additional cost	35.00	60.00
Five anchors	8.50	15.00
Two hundred ft. strand for anchor guys	2.25	2.50
Two half anchorages	5.00	10.00
Lags, champs, etc.	5.00	8.00
Per cent on material for handling	100.00	150.00
	$2,190.75	$3,005.50
Lightning arresters	10.00	20.00
Telephone system pro rated	75.00	100.00
If all 35-ft. poles are used (poles at $6.00 to $8.50)	260.00	320.00
If poles are anchored add	320.00	530.00
Total	$2,856.75	$3,975.50

In case transmission wires are required for transmission of electric energy from the power house to substations, such transmission wires may be placed entirely on cross arms, or in the case of three phase transmission, two of such wires may be on one two-pin arm and the third wire on a pin on the top of the pole or on a bracket on the side of the pole. Of course the pole top cannot be used if a ground wire is located at such point. The cost of construction on a three phase transmission line will approximate the figures given by Table III.

Table III.—Cost per mile of bracket construction single track 600 volt two No. 000 trolley wires, poles spaced 100 ft. with three phase 33,000 volt transmission line on trolley line poles, 2-pin cross-arm and pole top pin construction.

	From	To
Fifty-three 35-ft. poles in place and framed, poles delivered on cars at $6.00-$8.50	$ 455.00	$ 635.00
Ears, hangers, etc., in place	50.00	75.00
Fifty-three brackets in place with fittings	180.00	210.00
Two miles No. 000 trolley with splicer at 20c-26c.	1,100.00	1,400.00
Erecting same	100.00	150.00
Siding construction pro rated	75.00	100.00
Curve construction 1,500 ft. additional cost	65.00	100.00
Five anchors	8.50	15.00
Two hundred ft. strand for guys	2.25	2.50
Two half anchorages	5.00	10.00
Lags, clamps, etc.	5.00	8.00
Fifty-three 4x5 in. x 4 ft. 6 in. cross-arms	16.00	22.00
One hundred and fifty-nine 2x13 in. oak pins paraffined	9.00	11.00
One hundred and fifty-nine 33,000 volt porcelain insulators	90.00	120.00
One hundred and six 20x 1¼x¼ in. cross-arm braces galv.	5.00	6.50
One hundred and six ⅜x5 cge. bolts	1.00	1.25
Fifty-three ½x4 lag bolts	.60	.75
Fifty-three ⅝x13 mch. bolts	3.00	3.75
Erecting arms, pins and insulators	25.00	35.00
Three miles No. 2 copper wire with splicers at 20c-26c	638.40	829.92
Erecting same	125.00	170.00
Per cent on material for handling	140.00	190.00
Total	$3,098.75	$4,095.67

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Add for trolley lightning protection	10.00	20.00
Add for transmission lightning protection	50.00	250.00
Add for telephone system pro rated	75.00	100.00
Total	$3,233.75	$4,465.67
If all poles are anchored add	160.00	265.00
Total	$3,393.75	$4,730.67

From the above the principal unit costs of the cheapest practicable character of line work can be ascertained, and such additions must be made as are necessary for special overhead work around car shops, and in connection with bridges, city work or other special conditions; also the cost of copper for feeders or for transmission must be added in accordance with the plan decided upon.

The next consideration is as to whether or not there should be additional expenditures in order to increase reliability, or possibly to decrease maintenance or depreciation, or both. Some of the matters considered may be as follows: (1) Reduction of pole spacing; (2) increasing size of poles; (3) anchoring all poles.

Instead of using wooden poles the substitution for same of iron poles or possibly reinforced concrete poles, or, in extreme cases, which at present are not likely to be considered in connection with interurban electric railways, the use of steel bridges may be considered.

The matter of making stronger the supporting structure must necessarily be considered in connection with what it is to support, and frequently, also, in connection with the character of the ground.

Relative to the first, it is evident that the heavier the trolley wire the greater will be its strength, and therefore the greater the possible spacing of the supports, and also the greater the strength required at such supports. If catenary construction is used, usually the advisable spacing distance will be materially increased.

As to the second proposition, the less the first and maintenance cost per pole, then the nearer together the poles should be placed, but if the ground is rock, marsh, etc., it may be preferable to use structures allowing greater spacing and having increased unit cost, and possibly less cost per mile.

For standard trolley construction, the limit is usually 90 to 100 ft. spacing. These distances are determined, first, by the strains in the trolley wire when it is pulled tight enough to give a steady running trolley wheel, not having too great a kink at the point where the trolley wire is supported from the bracket; and second, by the mechanical strength of the ear and the trolley wire where it is attached to the ear; consequently, if it is desired to increase the spacing of the supporting structures in order to reduce first cost and also maintenance charges, some form of support for the trolley wire other than the ordinary ears and hangers must be used.

Wooden pole construction for single or double track can be made amply strong up to a spacing of 150 ft. by using poles of commercial size, if same are properly set and proper consideration is given to the nature of the ground, the necessity of guying, etc. This refers to pole strength and not to the supporting of the wire.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write direct to the advertisers and state that you saw the catalog mentioned in *Engineering-Contracting*. If you are in the market for tools, machinery or supplies tell us and we will notify promptly the leading manufacturers.

No. 0484. **Two-Piece Concrete Blocks.**—American Hydraulic Stone Co., Denver, Colo.

This 76-page pamphlet is an excellent example of trade catalog work. The principle of this system of block manufacture controlled by the company is clearly stated and this statement is followed by descriptions of block manufacture and construction, special work such as brick, paving block, partition blocks, veneer walls, and lintels, sills, etc. Results of fire and strength tests are given, and numerous concrete block buildings are described and illustrated. There are a number of testimonial letters from users and at the end there is a complete and very useful statement of the patents on blocks, block construction and block making machines and methods controlled by the company. Every engineer at all interested in concrete blocks should secure a copy of this pamphlet.

No. 0485. **Reinforced Concrete Factories and Warehouses.**—Turner Construction Co., New York, N. Y.

This is Bulletin No. 1 of a series to be issued by the company named above on subjects relating to reinforced concrete work. In this first bulletin the factory of the Robert Gair Co., in Brooklyn, N. Y., is described and illustrated. This building is some 200 ft. square and 9 stories high and is built throughout of reinforced concrete. Engineers should get their names on the company's mailing list for this series of bulletins.

No. 0486. **Electrical Instruments.**—General Electric Co., Schenectady, N. Y.

These two bulletins of 4 and 8 pages relate to meter testing and to direct current indicating instruments. The meter described consists of a Thomson induction meter registering revolutions of the disk instead of having a dial giving the kilowatt hours. The meter also contains current coils of different capacities so that by connecting each in circuit successively, a wide range of capacity for the tests is obtained while using the meter near the full load of the different coils. The test meter is connected in series with the meter under test, and a comparison made of the respective number of revolutions of the two disks in a given time. A simple calculation reduces the results to watt hours for the two meters and the percentage of error, if any, in the meter under test is quickly determined. Accuracy is maintained in the test meter by simple calibrations and the parts are readily accessible. The bulletin contains a description of the method of operation and diagram showing method of making the test. The direct current indicating instruments are constructed upon the well known D'Arsonval principle, and designed for switchboard use. The bulletin describes and illustrates their construction, and gives dimension diagrams of instruments and shunts, full sizes views of the scales, and data regarding catalog numbers, capacities, prices, etc. Damping is obtained by means of Foucault currents generated in an aluminum frame on which the coil is wound. The magnets are carefully hardened and aged, and an unusual high torque, combined with light moving elements and small magnetic air gap, make reasonable the manufacturer's claim of long life with continued accuracy. The frame is pivoted in a jewel bearing and the whole assembled in a round cast iron case which protects it from stray fields and renders the instrument dust proof.

Personals.

R. Angst, Chief Engineer of the Duluth & Iron Range R. R., died Dec. 1, at Duluth, Minn., aged 60 years.

Mr. John C. McMynn has resigned his connection with Robert W. Hunt & Co., taking effect Dec. 1st, 1907.

Everett B. Webster, of New York, President of the National Steel & Wire Co., died Nov. 29 in Jacksonville, Fla., aged 38 years.

Mr. Richard H. Gillespie has resigned his position as Assistant Engineer in the Engineering Department of the Borough of the Bronx, New York City.

Mr. Austin Lord Bowman, 53 Washington Sq. South, New York City, has been appointed Consulting Engineer in the Department of Bridges of New York City.

Messrs. J. F. Rowland, F. L. Allison and E. C. Hodgeson have organized the Carolina Construction Co., with headquarters at Asheville, N. C., and will engage in railroad contracting.

Mr. John C. Sheridan, of 805 Greene Ave., Brooklyn, N. Y., has been promoted from the position of Assistant Engineer to that of Chief Engineer in the Bureau of Highways, Borough of Brooklyn, New York City.

Mr. J. Y. Hill, heretofore Trainmaster of the Northern Alabama Ry., with headquarters at Sheffield, Ala., has been appointed Engineer of Maintenance of Way of the Southern Ry., with headquarters at Birmingham, Ala.

Mr. George H. Benzenberg, of Milwaukee, Wis., has been retained by the city of Pittsburg, Pa., as chief expert in the proceedings which are to be brought by that city looking to the purchase of the plant of the Monongahela Water Co.

The office of superintendent of construction on the Atlanta, Birmingham & Atlantic R. R. has been abolished, and all work and duties of that office have been transferred to the Engineering Department, under Alex. Bonnyman, Chief Engineer.

Lieut. Col. Dan C. Kingman and Major Hiram M. Chittenden, Corps of Engineers, U. S. A., have been directed to report to Brig.-Gen. John M. K. Davis, President of an army retiring board at Washington Barracks, D. C., Dec. 20, for examination.

Mr. Theodore P. Shonts, President of the Toledo, St. Louis and Western R. R. Co., and also President of the Interborough-Metropolitan Co., which controls the transit lines in Manhattan, has been elected President of the Chicago & Alton R. R. Co., to succeed Mr. S. M. Felton, resigned.

Mr. Frederick Seely, of 209 W. 135th St., New York, has been appointed an Assistant Engineer in the Plan Examining Division of the Building Department of the Borough of Manhattan. He succeeds Mr. Fred H. Dewey, who has resigned to enter the office of Mr. H. J. Hardenbergh, Architect, of 1 West 34th St., New York. Mr. Seely was formerly Assistant Engineer in the Topographical Bureau of Queens Borough, New York City, and previous to that had been an Inspector on U. S. Government work at the Brooklyn Navy Yard.

Capt. Robert R. Raymond, Corps of Engineers, U. S. A., has been relieved from duty with the Third Battalion of Engineers, Fort Leavenworth, and will report to Maj.-Gen. J. Franklin Bell, Chief of Staff, President Board of Ordnance and Fortification, for temporary special duty under his orders, retaining station at Fort Leavenworth. Upon the completion of such duty Captain Raymond will proceed to Denver and report to the commanding general, Department of the Colorado, for duty as chief engineer officer of that department, to relieve First Lieutenant George R. Spalding, Corps of Engineers.

Francis Hodgman, one of the founders of the Michigan Engineering Society, died Nov. 22, at his home in Climax, Mich., aged 68 years. Mr. Hodgman was graduated from the Michigan Agricultural College in 1862 with the degree of B. S., receiving the degree of M. S. three years later. He became County Surveyor of Kalamazoo County in 1868 remaining in that office until 1893 when he was compelled to give up active field work owing to ill health. In addition to his duties as County Surveyor he was engaged for about a year in the location and construction of the Rio Grande Western R. R. through the Wasatch Mountains in Utah. He also had part in the location and construction of the Marshall & Coldwater R. R. Mr. Hodgman was one of the founders of the Michigan Engineering Society and was its Secretary and Treasurer from 1886 to 1906 when he was elected President. In 1886 he brought out a treatise on land surveying which is considered as one of the standard authorities on questions in land surveying. In addition he has contributed numerous articles to engineering papers.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED

Bridges.

Dec. 11.	Houston, Tex.	Nov. 27
Dec. 12.	Brazil, Ind.	Dec. 11
Dec. 13.	Celina, O.	Dec. 11
Dec. 14.	Norwood, O.	Nov. 27
Dec. 16.	Altadena, Cal	Dec. 4
Dec. 16.	Hollidaysburg, Pa.	Dec. 11
Dec. 16.	Hartford, Conn.	Dec. 11
Dec. 17.	Dayton, O.	Dec. 11
Dec. 17.	Fort Worth, Tex	Dec. 11
Dec. 18.	Cleveland, O.	Nov. 27
Dec. 18.	Granville, Ind.	Dec. 4
Dec. 19.	Doniphan, Mo.	Dec. 11
Dec. 20.	Red Wing, Minn	Dec. 11
Dec. 27.	Baltimore, Md.	Dec. 11
Dec. 30.	Savannah, Ga.	Dec. 11
Jan. 2.	New Orleans, La	Dec. 4
Jan. 6.	Fort Monroe, Va.	Dec. 11
Jan. 6.	Colfax, La.	Dec. 11
Jan. 7.	Castle Haynes, N. C.	Nov. 20
Jan. 7.	Salem, S. Dak	Nov. 27
Feb. 13.	St. Charles, Mo	Oct. 30

Buildings.

Dec. 11.	Ladysmith, Ont.	Dec. 4
Dec. 12.	Whipple Barracks, Ariz	Nov. 20
Dec. 12.	Chicago, Ill.	Dec. 4
Dec. 12.	Chicago, Ill.	Dec. 4
Dec. 12.	Bayonne, N. J.	Dec. 4
Dec. 13.	Chicago, Ill.	Dec. 4
Dec. 14.	New Orleans, La	Dec. 4
Dec. 16.	Pulaski, Tenn.	Nov. 27
Dec. 16.	Painesville, O.	Dec. 4
Dec. 16.	Greenville, Tenn.	Dec. 11
Dec. 17.	Detroit, Mich.	Nov. 6
Dec. 17.	Pawnee, Okla.	Nov. 13
Dec. 17.	Hallock, Minn.	Dec. 4
Dec. 18.	Chicago, Ill.	Dec. 11
Dec. 19.	Ocala, Fla.	Nov. 13
Dec. 19.	Dayton, O.	Nov. 27
Dec. 19.	Milwaukee, Wis.	Dec. 11
Dec. 19.	Chicago, Ill.	Dec. 11
Dec. 21.	Fort Worth, Tex	Nov. 27
Dec. 21.	Madison, Kan.	Dec. 4
Dec. 21.	Washington, D. C.,	
Dec. 21.	Atlanta, Ga.	Dec. 11
Dec. 23.	Ann Arbor, Mich	Nov. 6
Dec. 23.	Fort Des Moines, Ia	Nov. 27
Dec. 23.	Soldiers Home, Cal	Dec. 4
Dec. 23.	Jersey City, N. J	Dec. 11
Dec. 26.	Richmond, Va.	Dec. 4
Dec. 27.	Tulalip, Wash.	Nov. 27
Dec. 27.	Tulalip, Wash.	Nov. 27
Dec. 27.	San Francisco, Cal	Dec. 4
Dec. 27.	Allentown, Pa.	Dec. 11
Dec. 30.	Lancaster, Pa.	Nov. 13
Dec. 30.	Monterey, Cal.	Dec. 11
Jan. 2.	Flint, Mich.	Nov. 13
Jan. 2.	South Bend, Ind	Nov. 20
Jan. 3.	Albuquerque, N. Mex	Nov. 20
Jan. 6.	Wichita, Kan.	Nov. 27
Jan. 6.	Cincinnati, O.	Dec. 4
Jan. 8.	Fort Spokane, Wash	Nov. 27
Jan. 10.	Cheyenne Agency, S. Dak	Nov. 27
Jan. 14.	York, Neb.	Dec. 11
Jan. 15.	Winnihago, Neb.	Dec. 4
Jan. 15.	Martinsburg, W. Va	Dec. 11
Jan. 15.	Houston, Tex.	Dec. 11
Jan. 17.	East Liverpool, O	Dec. 11
Jan. 18.	Pine Ridge, S. Dak	Dec. 4
Jan. 20.	Richmond, Va.	Dec. 11
Jan. 22.	Poplar, Mont.	Dec. 11

Roads and Streets.

Dec. 11.	Fort H. G. Wright, N. Y.	Nov. 27
Dec. 11.	Harrisburg, Pa.	Nov. 27
Dec. 11.	Columbus, O.	Dec. 4
Dec. 11.	Madisonville, O.	Dec. 4
Dec. 11.	Brooklyn, N. Y	Dec. 4
Dec. 12.	Flemington, N. J	Nov. 20
Dec. 12.	Anderson, Ind.	Nov. 27
Dec. 13.	Monticello, Ind.	Oct. 30
Dec. 13.	Harrisburg, Pa.	Nov. 27
Dec. 14.	Lebanon, Ind.	Nov. 13
Dec. 14.	Oakley, O.	Dec. 11
Dec. 14.	Danville, Ind.	Dec. 11
Dec. 16.	Steubenville, O.	Nov. 27
Dec. 16.	Harrisburg, Pa.	Dec. 4
Dec. 16.	Erie, Pa.	Dec. 4
Dec. 16.	Wilkesbarre, Pa.	Dec. 11
Dec. 16.	Columbus, Ind.	Dec. 11
Dec. 16.	Oklahoma City, Okla	Dec. 11
Dec. 17.	Providence, La.	Nov. 27
Dec. 20.	Washington, Pa.	Nov. 27
Dec. 21.	Apollo, Pa.	Dec. 11
Dec. 23.	Denver, Colo.	Dec. 11
Dec. 26.	Harrisburg, Pa.	Dec. 11
Dec. 27.	Amity, Pa.	Dec. 11
Dec. 31.	Wyalusing, Pa.	Dec. 11
Jan. 2.	Ridgefield, Conn.	Dec. 11
Jan. 2.	Little Rock, Ark	Dec. 11
Jan. 3.	Salt Lake City, Utah	Dec. 4
Feb. 4.	Billings, Mont.	Nov. 27

Sewers.

Dec. 11.	Brooklyn, N. Y	Dec. 4
Dec. 12.	St. Paul, Minn	Dec. 4
Dec. 13.	Evart, Mich.	Dec. 11
Dec. 14.	Belleville, Ill.	Dec. 11
Dec. 16.	St. Paul, Minn	Dec. 11
Dec. 17.	Louisville, Ky.	Nov. 27
Dec. 18.	Springfield, O.	Dec. 4
Dec. 18.	Brooklyn, N. Y	Dec. 11
Dec. 19.	St. Paul, Minn	Dec. 11
Dec. 28.	Evansville, Ind.	Dec. 4
Jan. 3.	Salt Lake City, Utah	Dec. 11
Jan. 6.	Hanley Falls, Minn	Dec. 11

Water Supply.

Dec. 12.	Cambridge Springs, Pa	Nov. 20
Dec. 17.	Camden, N. J	Oct. 16
Dec. 17.	McComb, Miss.	Deo 4
Dec. 18.	New York, N. Y	Dec. 11
Dec. 19.	Fort Dade, Fla	Nov. 27
Dec. 27.	Sauk Rapids, Minn	Dec. 11
Jan. 1.	Norway, Me.	Nov. 27
Jan. 8.	Tucson, Ariz.	Nov. 27
Jan. 10.	Phoenix, Ariz.	Dec. 11

Miscellaneous.

Dec. 11.	Montgomery, Ala.,	Bulkhead,	Nov. 27
Dec. 11.	New York, N. Y.,	Water Curtains,	Nov. 27
Dec. 11.	Baltimore, Md.,	Street Lighting,	Dec. 11
Dec. 12.	New York, N. Y.,	Trimming Scows, Etc.,	Dec. 4
Dec. 16.	Columbus, O.,	Electric Plant Work,	Dec. 11
Dec. 16.	New York, N. Y.,	Boat Repairs,	Dec. 11
Dec. 17.	Cincinnati, O.,	Flatboat,	Nov. 27
Dec. 17.	Philadelphia, Pa.,	Grade Crossing Work,	Nov. 27
Dec. 17.	Fort Hancock, N. J.,	Garbage Crematory,	Nov. 27
Dec. 17.	St. Paul, Minn.,	City Lighting,	Dec. 11
Dec. 18.	Madison, Wis.,	Concrete Work, Wrecking,	Nov. 13
Dec. 18.	New York, N. Y.,	Snow and Ice Removal,	Dec. 11
Dec. 18.	Baltimore, Md.,	Boiler Repairs,	Dec. 11
Dec. 20.	Portland, Ore.,	Steamboat,	Nov. 20
Dec. 20.	Lafayette, Ind.,	Electric Lighting,	Nov. 27
Dec. 20.	Chicago, Ill.,	Interior Finish,	Dec. 11
Dec. 21.	Chinook, Mont.,	Electric Light Works,	Nov. 20
Dec. 21.	Washington, D. C.,	Metal Work,	Dec. 4
Dec. 23.	Portland, Ore.,	Hydraulic Dredge,	Nov. 27
Dec. 27.	Boston, Mass.,	Wreck Removal,	Dec. 4
Dec. 27.	Paducah, Ky.,	Tenders,	Dec. 4
Dec. 30.	Dayton, O.,	Conduit System,	Dec. 11
Dec. 31.	Altoona, Pa.,	Garbage Disposal,	Dec. 11
Jan. 6.	Boston, Mass.,	Masonry, Etc.	Dec. 11
Jan. 10.	Indianapolis, Ind.,	Monument,	Dec. 11
Jan. 14.	Portland, Ore.,	Light Station,	Nov. 27
Jan. 14.	Columbus, O.,	Garbage Works,	Dec. 4
May 1.	Buenos Aires, Argentina,	Subways,	Nov. 20

Excavation, Earth and Rock.

Dec. 11.	Emmetsburg, Ia.,	Ditch Work,	Nov. 20
Dec. 11.	Fort H. G. Wright, N. Y.,	Grading, Filling, Etc.,	Nov. 27
Dec. 11.	Brooklyn, N. Y.,	Grading Lot,	Dec. 4
Dec. 12.	Jersey City, N. J.,	School Ground Improvement.	Dec. 11
Dec. 13.	Minneapolis, Minn.,	Ditch,	Dec. 11
Dec. 14.	Boston, Mass.,	Dredging,	Nov. 27
Dec. 14.	Webster City, Ia.	Drainage Ditches,	Dec. 4
Dec. 16.	New Orleans, La.,	Levee Work,	Dec. 4
Dec. 17.	Greenfield, Ind.,	Ditch Work,	Dec. 11
Dec. 20.	Mount Vernon, Ind.,	Drainage Work,	Dec. 4
Dec. 23,	Montreal, Que.,	Railroad Work,	Dec. 11
Jan. 7.	De Smet, S. Dak.,	Ditch Work,	Dec. 11

Materials, Machines, Supplies, Tools, Etc.

Dec. 11.	Washington, D. C.,	Sheet Copper,	Nov. 27
Dec. 12.	Lincoln, Neb.,	Pumps,	Dec. 11
Dec. 12.	University, Ala.,	Power House Equipment,	Dec. 11
Dec. 13.	Washington, D. C.,	Lumber, Angles, Etc.,	Nov. 20
Dec. 13.	Chicago, Ill,	Lubricating Oil,	Dec. 4
Dec. 14.	Chicago, Ill.,	Hydrant Basin Covers,	Dec. 11
Dec. 14.	Chicago, Ill.,	Valve Basin Covers,	Dec. 11
Dec. 13.	Chicago, Ill,	Ferrules,	Dec 4
Dec. 13.	Chcago, Ill.,	Gate Valves,	Dec. 4
Dec. 14.	Nashville, Tenn.,	Lumber,	Nov. 20
Dec. 16.	Tompkinsville, N. Y.,	Lanterns,	Nov. 20
Dec. 16.	Philadelphia, Pa.,	Fire Hose,	Dec. 11
Dec. 17.	Washington, D. C.,	Milling Machines, Etc.,	Dec. 4
Dec. 17.	Charleston, S. C.,	Crossties,	Dec. 11
Dec. 18.	Baltimore, Md.,	Window Guards, Gates,	Dec. 11
Dec. 18.	Baltimore, Md.,	Pipe Cement, Etc.,	Dec. 11
Dec. 19.	Pittsburg, Pa.,	Boilers, Generator Sets, Etc.,	Dec. 11
Dec. 19.	Chicago, Ill.,	Cement, Sewer Pipe, Etc.,	Dec. 11
Dec. 20.	Ashville, O.,	Arc Lamps, Wire,	Dec. 4
Dec. 20.	Chicago, Ill.,	Heating Apparatus,	Dec. 11
Dec. 20.	Chicago, Ill.,	Freight Elevator,	Dec. 11
Dec. 21.	Washington, D. C.,	Dump Barges,	Nov. 27
Dec. 23.	Washington, D. C.,	Electrical Materials,	Dec. 4
Dec. 27.	Washington, D. C.,	Pipe, Chain, Rope, Etc.,	Dec. 4
Dec. 27.	New York, N. Y.,	Vacuum Cleaning System,	Dec. 11
Jan. 2.	Washington, D. C.,	Steam Gages, Valves, Etc.,	Dec. 11
Jan. 2.	Jersey City, N. J.,	Broken Stone, Wire, Etc.,	Dec. 11
Jan. 15.	Manila, P. I.,	Pumps and Motors,	Oct. 30
Jan. 15.	Winnipeg, Man.,	Water Pipe,	Dec. 4
Jan. 15.	Washington, D. C.,	Pumps, Motors, Cranes, Etc.,	Dec. 11

BIDS ASKED

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Hartford, Conn.—Until noon, Dec. 16, by Connecticut River Bridge and Highway District, John T. Henderson, Deputy Chief Engineer, for the sale of the superstructure of the present temporary highway bridge across the Connecticut River at Hartford. The bridge is a through bridge built of steel, 30 ft. center to center of trusses; wooden floor; composed of nine spans, lengths as follows: Three spans of 116 ft. each, two spans of 136 ft. each, three spans of 106 ft. each, one span of 80 ft., and designed to carry a 14-ton trolley car. The floor beams are 20-in. 80-lb. I's.

Savannah, Ga.—Until noon, Dec. 30, by Commissioners of Chatham County, G. Reuben Butler, Clerk, for furnishing the material and erecting a steel highway draw bridge over the Great Ogeechee River at King's Ferry.

Brazil, Ind.—Until 11:30 p. m., Dec. 12, by County Commissioners, for construction of approaches to new bridge over Eel River.

Colfax, La.—Until Jan. 6, by J. B. Roberts, Clerk Police Jury, for constructing two bridges.

Baltimore, Md.—Until 11 a. m., Dec. 27, by B. F. Fendall, City Engineer, for the construction of the concrete bridge across Gwynn's Falls Valley, on the line of Edmondson Ave., Baltimore.

Red Wing, Minn.—Until Dec. 20, by County Auditor, for constructing steel or reinforced concrete bridge, 60 ft. long, over Bullid Creek in Town of Hay Creek.

Doniphan, Mo.—Until Dec. 19, by James McKenzie, County Road and Bridge Commissioner, for a bridge and approaches 150 ft. long and 12 ft. roadway, built on piling.

Celina, O.—Until Dec. 13, by W. A. Weisk, County Auditor, for construction of superstructure of steel bridge over Blackcreek Ditch, known as the Johnson bridge.

Dayton, O.—Until noon, Dec. 17, by W. A. Maynes, Clerk Board Public Service, for re-erecting two of the old spans of the Stratford Ave. bridge at the mouth of Wolf Creek, including all necessary oak plank and joists for new floor and guard railing complete; also for cleaning and repainting said two spans; also for 730 cu. yds. of steel reinforced concrete for the abutment piers and wing walls, including excavations. Estimated cost of work is $9,000.

Hollidaysburg, Pa.—Until 10 a. m., Dec. 16, by W. S. Hostler, County Clerk, for constructing steel bridge over Bobbs Creek; also for masonry work for three bridges.

Fort Worth, Tex.—Until Dec. 17, by County Commissioners Court, for erection of bridge over Rush Creek on Collier and Collins Road. Bridge is to be 40 ft. long with 12 ft. steel piers.

Fort Monroe, Va.—Until noon, Jan. 6, by Capt. Ernest R. Tilton, Constructing Q. M., for reconstructing Mill Creek bridge at Fort Monroe.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Monterey, Cal.—Until 11 a. m., Dec. 30, by Jno. L. Clem, Chief Q. M., San Francisco, for furnishing and installing electric lighting fixtures in a double set of non-commissioned officers' quarters for sergeant 1st class, hospital corps, at the Presidio of Monterey, Cal.

Atlanta, Ga.—Until 2 p. m., Dec. 21, by Board of Education, L. Z. Rosser, President, for building a new grammar school in the 5th ward. Plans, etc., with Haralson Bleckley, Architect, 619 Empire Bldg., Atlanta.

Chicago, Ill.—Until 11 a. m., Dec. 19, by Department Public Works, 322 City Hall, for labor and material for constructing 3-story and basement brick and stone police station at 75th St. and Jackson Ave. Separate bids asked for cell work, iron work, mason, cut stone, etc.

Chicago, Ill.—Until 11 a. m., Dec. 18, by Department Public Works, 322 City Hall, for labor and material for constructing 3-story and basement brick and stone police station at 39th St. and California Ave. Separate bids asked for cell work, iron work, masonry, cut stone work, etc.

Poplar, Mont.—Until 2 p. m., Jan. 22, by Commissioner of Indian Affairs, Washington, D. C., for constructing teachers' cottage at Day School No. 1, Fort Peck Agency. Further information may be obtained from C. B. Lohmiller, Superintendent, Poplar.

York, Neb.—Until 3 p. m., Jan. 14, by James Knox Taylor, Supervising Architect, Washington, D. C., for construction including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the U. S. Post Office at York, Neb.

Jersey City, N. J.—Until 3 p. m., Dec. 23, by Board of Finance, Oliver H. Perry, Chairman, City Hall, for construction of public bath building at 14th St. and Erie St. Surety required is $25,000.

East Liverpool, O.—Until 3 p. m., Jan. 17, by James Knox Taylor, Supervising Architect, Washington, D. C., for construction (complete) of U. S. Post Office at East Liverpool.

Allentown, Pa.—Until Dec. 27 (Readvertisement), by County Commissioner, for constructing addition to jail. All bids previously received for this work were rejected. Only one bid on the complete work was received.

Greenville, Tenn.—Until 11 a. m., Dec. 16, by Maj. M. Gray Zalinski, Q. M., Washington, D. C., for constructing brick lodge and outbuilding, concrete walls and sidewalks, grading, etc., at the Greenville, Tenn., National Cemetery.

Houston, Tex.—Until 3 p. m., Jan. 15, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction (including plumbing, heating appartus, electric conduits and wiring) of U. S. Post Office and Custom House at Houston.

Richmond, Va.—Until 3 p. m., Jan. 20, by C. P. Walford, Clerk and Supervisor, City Hall, for the construction of a high school building in accordance with plans, specifications and details furnished by Chas. K. Bryant, Architect, 1014 East Main St.

Milwaukee, Wis.—Until 10:30 a. m., Dec. 19, by Charles J. Poetsch, Chairman Board Public Works, for constructing a lavatory at the Menomonee special sewerage pumping station on Jones Island, in the 5th Ward.

Martinsburg, W. Va.—Until Jan. 15, by Lewis H. Thompson, Chairman Building Committee, for erection of new Y. M. C. A. building at this place. Plans and specifications can be obtained from Mr. Thompson until Dec. 15.

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Little Rock, Ark.—Until noon, Jan. 2, by Gerhard Morgner, Engineer in Charge of Road Improvement District, for construction of W. 12th St., for a distance of 19,683 ft.

Denver, Colo.—Until Dec. 23, by T. W. Jaycox, State Engineer, Denver, for construction and repair of flume and wagon road on Willow Creek, near Creede, Colo.

Ridgefield, Conn.—Until Jan. 2, by Board of Selectmen, for improvement of section of road by grading and graveling.

Columbus, Ind.—Until Dec. 16, by City Council, for constructing cement walks.

Danville, Ind.—Until Dec. 14, by D. D. Mills, County Auditor for constructing gravel road, 6,600 ft. long, in Marion Township.

Oakley (P. O. Cincinnati), O.—Until noon, Dec. 14, by David K. Mason, Village Clerk, for grading and macadamizing and graveling roadway of Williams Ave. Walter E. Sullivan, Village Engineer, 907 Commercial Tribune Bldg., Cincinnati.

Oklahoma City, Okla.—Until 5 p. m., Dec. 16, by Geo. Hess, City Clerk, for paving portions of California Ave., 6th St. and Lee Ave.

Amity, Pa.—Until Dec. 27, by Joseph W. Hunter, State Highway Commissioner, Harrisburg, Pa., for constructing a road in Amity Township, Berks County.

Apollo, Pa.—Until Dec. 21, by Joseph W. Hunter, State Highway Commissioner, Harrisburg, Pa., for constructing road in Apollo Borough, Armstrong County.

Harrisburg, Pa.—Until Dec. 26, by Joseph W. Hunter, State Highway Commissioner, for constructing following roads: Pine Township road, Mercer County; road in Wayne Township, Schuylkill County; road in Pine Grove Township, Schuylkill County; road in Franklin Township, Fayette County; road in Perry Township, Fayette County.

Wilkesbarre, Pa.—Until 2 p. m., Dec. 16, by J. M. Norris, County Controller, for county road work at Bridge.

Wyalusing, Pa.—Until Dec. 31, by Joseph W. Hunter, State Highway Commissioner, Harrisburg, Pa., for constructing road in Wyalusing Township, Bradford County.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Belleville, Ill.—Until Dec. 14, by Board Local Improvements, for constructing sewers in portions of several streets.

Evart, Mich.—Until 6 p. m., Dec. 13, by Irvin Chase, Village Clerk, for constructing sanitary district sewer system, consisting of 4,766 lin. ft. of 10-in., 15-in., and 20-in. pipe sewer, together with Y's and manholes.

Hanley Falls, Minn.—Until 8 p. m., Jan. 6, by J. M. Hardy, Village Recorder, for construction of sewers.

St. Paul, Minn.—Until 2 p. m., Dec. 16, by R. L. Gorman, Clerk Board Public Works, for constructing sewer in Stickney, Gates and Page Sts.; also for sewer in Armstrong Ave.

St. Paul, Minn.—Until 2 p. m., Dec. 19, by R. L. Gorman, Clerk Board Public Works, for constructing sewer in Hastings Ave., Point Douglas Road, Douglas St., Pacific St. and Burns Ave.

Brooklyn, N. Y.—Until 11 a. m., Dec. 18, by Bird S. Coler, Borough President, for constructing two sewer basins, and for five contracts for constructing sewers, estimated cost ranging from $540 to $1,948.

Salt Lake City, Utah.—Until 8 p. m., Jan. 3, by F. J. Leonard, Chairman Board Public Works, for constructing pipe sewers in sewer extension No. 191. L. C. Kelsey, City Engineer.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Phoenix, Ariz.—Until 4 p. m., Jan. 10 (Readvertisement), by Robert A. Craig, Superintendent of Water Department, for laying cast iron water pipe. Official advertisement will be found elsewhere in this issue.

Sauk Rapids, Minn.—Until 8 p. m., Dec. 27, by Village Clerk, for constructing water works, to consist of about two miles of cast iron distribution pipe line system and 75,000 gallon steel tank and steel tower. Oscar Claussen, 514 German Am. Bank Bldg., St. Paul, Minn., is Consulting Engineer.

New York, N. Y.—Until 2 p. m., Dec. 18, by John H. O'Brien, Commissioner Water Supply, Gas and Electricity, 73 Park Row, for furnishing, delivering and constructing gate vaults for the high pressure pumping stations located at Gansevoort and West Sts. and at Oliver and South Sts., Borough of Manhattan. Security required is $1,000.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

Greenfield, Ind.—Ditch Work.—Until Dec. 17, by County Commissioner for constructing ditch, the work including about 8,400 ft. of 6-in., 8-in., 10-in., 12-in. and 15-in. tile drain, etc.

Boston, Mass.—Embankment, Etc.—See under Bids Asked—Miscellaneous.

Minneapolis, Minn.—Ditch.—Until Dec. 13, by Hugh R. Scott, County Auditor, for constructing a ditch.

Jersey City, N. J.—School Grounds Improvement.—Until 9 p. m., Dec. 12, by Fred Ege, Secretary Board of Education, City Hall, for improvement of grounds of School No. 18, on Storm Ave., in accordance with the plans and specifications on file in the office of the Supervising Architect, John T. Rowland, Jr., 15 Exchange Place. .

De Smet, S. Dak.—Ditch Work.—Until Jan. 7, by P. A. Carroll, County Auditor, for constructing Drainage Ditch No. 1, in Baker Township.

Greenville, Tenn.—Grading.—See under Bids Asked—Buildings.

Montreal, Que.—Railroad Work.—Grand Trunk Pacific Ry., B. B. Kelliher, Chief Engineer, Montreal, Que., is stated to have called for bids to be opened Dec. 23, for the construction of 120 miles of railroad west of Edmonton.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Chicago, Ill.—Interior Finish.—Until 11 a. m., Dec. 20, by Department Public Works, 325 City Hall, for labor and materials for constructing interior finish of basement and engine pit at Chicago Ave. pumping station.

Indianapolis, Ind.—Monuments.—Until Jan. 10, by Indiana-Vicksburg Monument Commission, 25 State House, Indianapolis, for the making and placing of the Indiana monuments on the Vicksburg battle field. H. C. Adams is Chairman.

Boston, Mass.—Masonry, Etc.—Until 2:30 p. m., Jan. 6, Charles River Basin Commission, Hiram A. Miller, Chief Engineer, 367 Boylston St., Boston, for building Sec. 6 of the Boston Marginal Conduit and Sec. 4 of the Boston Embankment, requiring about 18,000 cu. yds. of earth fill, 29,000 lin. ft. of piles, 3,000 cu. yds. of concrete masonry, 240 cu. yds. of stone masonry, 400 tons of riprap, the removal of about 600 cu. yds.

of masonry and the construction of three cofferdams. The work to be done includes the construction of a gate-chamber at the junction of the existing Stony Brook conduits and the Boston Marginal Conduit. The embankment will be made along the Boston side of the Charles River at the Fens and will be about 140 ft. long and 100 ft. wide.

Baltimore, Md.—Boiler Repairs.—Until 11 a. m., Dec. 18, by James Bosley, Commissioner of Health, for repairing boiler in the quarantine tugboat E. Clay Timanus.

Baltimore, Md.—Street Lighting.—Until 11 a. m., Dec. 11, by Robert J. McCuen, Superintendent of Lamps and Lighting, for street gas and naphtha lamp fixtures, operation and maintenance, marked: "Proposals for furnishing incandescent gas and naphtha street lighting equipment for all the street gas and naphtha lamps in the city of Baltimore."

St. Paul, Minn.—City Lighting.—Until 5 p. m., Dec. 17, by George T. Redington, City Clerk, for lighting certain streets and public grounds, in the city of St. Paul, by gas, gasoline and electricity, during the year 1908, and for separate and distinct parts thereof.

New York, N. Y.—Snow and Ice Removal.—Until noon, Dec. 18 (readvertisement), by Foster Crowell, Commissioner of Street Cleaning, 13 Park Row, for labor and materials required for removal of snow and ice from the Boroughs of Manhattan and the Bronx. The work is divided into districts, the security required for a bid on all 13 districts being $100,000.

New York, N. Y.—Boat Repairs.—Until 11 a. m., Dec. 16, by John V. Coggey, Commissioner of Correction, 148 E. 20th St., for furnishing all the labor and materials required for repairs to steamer "Minnahanonck."

Columbus, O.—Electric Plant Work.—Until Dec. 16, by E. F. McGuire, Secretary Board Public Service, for furnishing labor and material for the improvements at the municipal electric light plant, Dublin Ave.

Dayton, O.—Conduit System.—Until Dec. 30, by Chas F. Hall, President Board, for furnishing, delivering and installing a complete underground conduit and cable system and exchange improvements for the police and fire departments.

Altoona, Pa.—Garbage Disposal.—Until Dec. 31 (extension of date from Dec. 4), by S. B. Trees, Secretary Board of Health, for collection and disposal of garbage in this city.

Greenville, Tenn.—Concrete Walls.— See under Bids Asked—Buildings. .

Materials,Machines,Supplies,Tools,Etc.

Bids are asked on following work, the notes being arranged alphabetically by states:

University, Ala.—Power House Equipment.—Until noon, Dec. 12, by John W. Abercrombie, President University of Alabama, for furnishing 500 hp. water tube boilers (three boilers); one or two 100 k. w. d. c. generators and accessories; one or two 125 hp. automatic, four valve or Corliss engines, complete; one 25 k. w. a. c. generator with exciter; 500 hp. capacity heater and separator.

Washington, D. C.—Steam Gages, Valves, Etc.—Until 10:30 a. m., Jan. 2, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Circular No. 407, steam gages, valves, inspirators, sight feed lubricators, injectors, etc., and repair parts for above fittings.

Washington, D. C.—Pumps, Motors, Cranes, Etc.—Until noon, Jan. 15, by Elliott Woods, Superintendent, U. S. Capitol Building and Grounds, Washington, D. C., for furnishing boiler feed pumps, barometric condensers, centrifugal pumps, motors, cranes, and chimneys. Bids will be submitted for each item separately.

Chicago, Ill.—Hydrant Basin Covers.—Until 11 a. m., Dec. 14, by Department Public Works, 317 City Hall, for furnishing and delivering 200 tons of cast iron hydrant basin covers.

Chicago, Ill.—Valve Basin Covers.—Until 11 a. m., Dec. 14, by Department Public Works, 317 City Hall, for furnishing and delivering 440 tons of cast iron covers for valve basins.

Chicago, Ill.—Freight Elevator.—Until 11 a. m., Dec. 20, by Department Public Works, 325 City Hall, for furnishing and erecting in place electric freight elevator in new meter building on west side of Indiana Ave., between 13th and 14th Sts.

Chicago, Ill.—Heating Apparatus.—Until 11 a. m., Dec. 20, by Department Public Works, 221 City Hall, for constructing complete, ready for service, steam heating apparatus required for Lawrence Ave. pumping station.

Chicago, Ill.—Cement, Sewer Pipe, Etc.—Until 2 p. m., Dec. 19, by Board of Inspectors, House of Correction, 26th and California Ave., for furnishing and delivering such articles as leather and findings, hardware, paints, oils, electrical supplies, steamfitters', engineers' supplies, cement, sand, lumber, sewer pipe, etc., as may be required during the quarter beginning Jan. 1, 1908.

Baltimore, Md.—Pipe, Cement, Etc.—Until 11 a. m., Dec. 18, by Alfred M. Quick, Water Engineer, for furnishing and delivering to the Water Board such supplies as may be required for the year ending Dec. 31, 1908, including lumber, wood, oils, brick, cement, cast iron work, lead-lined iron pipe, cast iron pipe and fittings, brass castings, feed, rubber and packing, paints, waste, tools and water meters, and hauling pipe, pipe fittings, etc., for the year 1908.

Baltimore, Md.—Window Guards, Gates.—Until 3 p. m., Dec. 18, by James Knox Taylor, Supervising Architect, Washington, D. C., for iron window guards and gates for U. S. Custom House, Baltimore.

Lincoln, Neb.—Pumps.—Until Dec. 12, according to reports, by Thos. H. Pratt, City Clerk, for two pumps of a capacity of 800 gallons per minute each.

Jersey City, N. J.—Broken Stone, Wire, Etc.—Until 12:15 p. m., Jan. 2, by Boulevard Commissioners, John C. Sweeney, Clerk, 580 Newark Ave., for furnishing supplies, during fiscal year, among which are the following: 2,500 yds. broken stone, as may be required, in sizes 2½ to 1½; 1,000 yrs. road gravel, Roa Hook, Shark River, or equivalent; 1,000 yds. Pike County shale; 500 gallons cylinder oil; 500 gallons engine oil; 5,000 ft. No. 6 R. C. electric line wire; 3,000 ft. No. 6 twin (duplex) R. C. wire braided, 2 color cores; 1,000 ft. ¼-in. galvanized guy wire; 1,000 ¼-in. mast arm wire; 2,000 arc light globes; 2,500 assorted trees, 3 to 4-in. at butt, Linden, Oriental Plain, Mountain Ash or Dwarf Poplar, as may be required; 50,000 elliptical copper coated carbons, 1 in. by 11¾ in.; 50,000 elliptical copper coated carbons, 1 in. by 7¼ in.; 50,000 round copper coated carbons, ½ in. by 12 in.; 250 chestnut poles, straight, clean and sound, 35 ft. long, butt 12 to 14 in.

New York, N. Y.—Vacuum Cleaning System.—Until 3 p. m., Dec. 27, by James Knox Taylor, Supervising Architect, Washington, D. C., for the installation of a vacuum cleaning system for the U. S. Custom House Building, New York. Drawings and specification at the office of the Architect, No. 11 East 24th St., New York, N. Y.

Philadelphia, Pa.—Fire Hose.—Until Dec. 16, by George R. Stearns, Director Public Works, for furnishing fire hose.

Pittsburg, Pa.—Boilers, Generator Set, Etc.—Until 10:30 a. m., Dec. 19, by Jas. P. Shaw, Director of Charities and Correction, care City Controller, for construction, delivery and erection of one 150 k. w. engine generator set, moving and repairing present generator set, six 250 hp. boilers, six automatic stokers, coal conveyor system with bunkers and spouts, feed water filter, boiler feed pumps, switchboard, moving and repairing the refrigerating engine in the ice plant of the Department of Charities and Correction at Marshalsea Station, P., C., C. C. & St. L. Ry. Plans, etc., at office of John P. Brennan, Assistant Superintendent of Bureau of Building Inspection, Public Safety Building, corner of 6th Ave. and Cherry Alley, Pittsburg.

Charleston, S. C.—Crossties.—Until Dec. 17, by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at Navy Yard, Charleston, 1,500 cypress crossties. Applications for proposals should refer to Schedule 587.

CONTRACTS LET.

The following contracts have been let recently:

Bisbee, Ariz.—Grading.—Andrew Scott of Scott Transfer Co., Douglas, Ariz., for grading for additional track for Southwestern R. R. to the Sacramento mine shaft.

Fresno, Cal.—Bridge—Pacific Construction Co., at $14,983, for wooden trestle bridge over Kings River at Hardwick for county. Other bids were: Western Bridge & Construction Co., Omaha, Neb., $16,300; Worsick Street Paving Co., $15,181.

Oakland, Cal.—Sewer—C. D. Vincent, Oakland, at $88,599, for constructing east side extension sewer between E. 8th and E. 12th Sts.

Glastonberry, Conn.—Power Plant.—Fred T. Ley Construction Co., Springfield, Mass., for entire plant for Glastonberry Power Co.

Washington, D. C.—Sewer.—E. G. Gummell, 612 F St., N. W., $12,925, for constructing sewers in Arkansas Ave. and Delafield St. The other bids were: W. F. Brenizer Co., $13,481; R. J. Beall Construction Co., $15,991.

Tampa, Fla.—Bridge Approaches.—M. V. Johns, for building approaches for Seaboard Air Line Ry. bridge, which will be erected between the bay front and Grassy Island.

Atlanta, Ga.—Paving.—Venable Bros., Temple Court, at $3.98, for wooden block paving, and $2.65 for granite block, for improvement of Broad St.

Mattoon, Ill.—Sewer.—Baum Construction Co., Paris, Ill., at $1,419, for constructing sewer in alley.

Summit, Ill.—Sewer System.—Federal Improvement Co., The Rookery, at $75,000, for constructing sewer system here for the Corn Products Mfg. Co.

Indianapolis, Ind.—Road Work.—Francis E. Lackey for cement walks and curb on Adams St., and for graveling roadway.

Indianapolis, Ind.—Building Work.—Hetherington & Berner for iron and steel work for new office and bank building at Delaware and Market Sts.

Kendallville, Ind.— Sewer.— Moellering Construction Co., Fort Wayne, Ind., at $4,946 for sewer here.

Logansport, Ind.—Gravel Roads.—Daniel Mahoney, at $20,650, for constructing seven miles of gravel roads.

Portland, Ind.—Road Work.—Alban Stroble, at $7,875, for D. R. Williamson road, 10,533 ft. long; Lowry & Mannix, Fort Recovery, O., at $3,500, for J. W. Williamson road, 1 mile long.

Vincennes, Ind.—Gravel Roads.—O. W. Holmes, Bicknell, Ind., at $9,300, for Martin Wampler gravel road; Hugh O'Donnell, Vincennes, at $4,427, for Fred C. Miller gravel road.

Elkhart, Ind.—Bridge.—Elkhart Iron & Bridge Co., at $12,477, for repairing bridge in this city.

Terre Haute, Ind.—Building. — Modern Construction Co., for erecting Elks' Home.

Muncie, Ind.—Bridges. — Indiana Bridge Co., Muncie, at $35,000, for constructing two county bridges, one over Mississinewa River at Blacks Mills, the other over White River at Yorktown.

Jefferson City, Mo.—Steel Bridge.—Canton Bridge Co., Canton, O., at $3,418, for new steel bridge, 125 ft. span, over the Moreau for the county.

Chillicothe, Mo.—Paving.—James E. Meek, Chillicothe, at following bid, for paving: Earth excavation 19 cts. per cu. yd.; curbing, 29 cts. per lin. ft.; paving, $1.24 per sq. yd.

Fargo, N. Dak.—Water Mains, Sewer Connections.—C. H. Porritt, at $1.49 per lin. ft., for putting in water main in 9th ave.; W. J. Sheehan, for putting in sewer and water connections on N. P. ave., west of Broadway.

Cape May, N. J.—Jetty.—Seacoast Construction Co., New York, at $614,000, for constructing jetty at Cold Spring Inlet, Cape May, for U. S. Government.

Dayton, O.—Sewers.—Backus Construction Co., for sanitary sewers on Bierce and Gerlough aves.

Lancaster, O.—Masonry.—Hine Bros., at $4.50 per perch of 25 cu. ft., for constructing two abutments for bridge over Hocking River.

Chester, Pa.—Bridge Work.—J. Howard Chetney, at $1,650, for repairing inter-county bridge at Chadds' Ford.

Dunmore, Pa.—Sewer.—O'Boyle Bros., for constructing sewer here.

Danville, Pa.—Buildings.—Mosier & Summers, 1266 Seneca St., Buffalo, N. Y., at $252,290, for constructing state hospital buildings at this place.

Hollidaysburg, Pa.—Masonry.—C. Dodson, for masonry work for county bridge.

McKeesport, Pa.—Street Work.—Henry Bolar at $2,695 for improvement of Scott St.

Washington, Pa.—Road Work. — N. C. Hunter, for completing contract for constructing Water Works Road for County Commissioners.

Fort Worth, Tex.—Bridge.—M. S. Hasle, for constructing bridge over Rush Creek for county.

Norfolk, Va.—Sewers.—Duffy & Co., at $34,075, for lateral sewer system in 7th ward, to include 1,000 lin. ft. 10-in. and 24,000 lin. ft. 8-in. terra cotta pipe, 24,000 lin. ft. of 4-in. terra cotta house connections, 50 manholes and 35 flush tanks.

Toronto, Ont.—Railroad, Etc. — Public Works Department has let the contract of the construction of a railroad 20 miles in length from the Temiskaming & Northern Ontario Ry. through Bryce and James Townships to the Montreal River mining district, Long & Twain, of Haileybury, Ont. A. & E. Akerlund, also of Haileybury, have secured the contract for the construction of six miles of road from Thornloe through Cane and Barber Townships to the Montreal River, and David Chambers, of Charlton, Ont., has a contract for the building of a winter road from Charlton to the Earlton and Outlake road.

PROJECTED WORK.

Bridges.

Items Arranged Alphabetically by States.

Los Angeles, Cal.—Union Iron Works, at about $52,000, was reported to be low bidder Nov. 25, for new Macy St. bridge over Arroyo de los Pesos.

San Francisco, Cal.—City Council has set aside $10,000 to aid the state in building an overhead bridge for foot passengers from Market St. crossing east at the ferry.

Atlanta, Ga.—Georgia Railway & Electric Co. has asked permission of the board of county commissioners to close up the present bridge over the Western & Atlantic R. R. at the Exposition cotton mills, and erect a new one there.

Boise, Idaho.—A petition is being circulated asking the council to call an election for the purpose of voting $7,500 in bonds for the building of three bridges, one on 7th St. opposite the new city hall, one on Kimball Ave. on the site of the present bridge and one on 9th Ave. at the crossing of Arthur St.

Hazelton, Ind.—Advices from this place state that engineers are engaged in work preliminary to the construction of the bridge of the Chicago, Indianapolis & Evansville across White River at Giro, a small town near the line of Pike and Gibson counties.

Lexington, Ky.—A movement is being agitated to have a viaduct built across the Louisville & Nashville tracks on West Main St. from the Cox St. hill to the Cemetery gate hill.

Grand Rapids, Mich.—Plans for the new foot bridge which the council ordered to be placed beneath the Grand Trunk R. R. bridge in the northern part of the city are now being prepared under the direction of the Board of Public Works and the work will be advertised at once.

Kansas City, Mo.—Chicago, Burlington & Quincy R. R., according to advices from this city, will erect a new bridge over the Missouri River either beside the present structure or further down the river near Randolph. Work, however, will probably not be begun for two years.

Kansas City, Mo.—The franchise granting the Commercial Improvement Co. permission to build and maintain a viaduct on Main St. from 20th to 23d Sts. has been accepted by that company. It is estimated that the structure will cost $135,000.

St. Louis, Mo.—Plans to bridge and tunnel the Compton Ave. tract between Cardinal and Grand Aves. have been submitted to the Municipal Bridge and Terminal Commission by the Executive Committee of the Terminal R. R. Association of St. Louis, of which W. S. McChesney, Jr., is President.

Cincinnati, O.—City Engineer Danenhower has submitted to Board of Public Service estimates of cost of reconstructing and repairing 8th St. viaduct. Work will cost about $106,000.

Cleveland, O.—A. B. Lea, County Engineer, County Court House, has plans under way for the construction by the county of concrete bridge over the Rocky River at the village of Rocky River. The bridge as proposed will be 60 ft. wide and will be between 250 and 300 ft. long, and will cost about $250,000. Plans have also been completed by the County Engineer for a single span 45 ft. long, 52 ft. wide, reinforced concrete bridge to be erected by the county over Euclid Creek on St. Clair Ave. at a cost of about $10,000.

Cleveland, O.—William J. Carter, City Engineer, has reported that draw span of Central viaduct could be replaced by a solid span at a cost of $100,000.

Portsmouth, O.—Council has passed ordinance providing $20,000 toward constructing a viaduct under the Norfolk & Western Railway Co.'s tracks and the Baltimore & Ohio South Western Railway Co.'s tracks at Kendall Ave.

Portland, Ore.—North-East Side Improvement Association, M. G. Munly, President, is advocating an issue of bonds for the construction of a suspension bridge across the Willamette River at some point north of the Steel bridge. The bridge would cost $1,250,000.

Reading, Pa.—Elmer H. Beard, City Engineer, has completed plans for bridge over Lebanon Valley R. R. tracks at Tulpehocken St. Plans call for concrete structure with 80 ft. span, 30 ft. wide.

West Chester, Pa.—County Commissioners intend to make repairs to a number of bridges in the county at an expense of several thousand dollers.

Seattle, Wash.—Plans for overhead steel bridges at Holgate and Stacy Sts. to be constructed by the Columbia & Puget Sound and the Northern Pacific Rys. have been submitted to the Engineering department of the city in order that the necessary approaches may be worked out. Each of the structures will cost about $75,000. H. E. Stevens, St. Paul, Minn., is Engineer of Bridges, N. P. Ry.

Juneau, Wis.—The County Board of Supervisors of Jefferson County has made an appropriation of $7,000 to build a new bridge at Hubbleton, to replace the old one.

Wheeling, W. Va.—City Engineer Cooke has prepared preliminary plans for a deck bridge 66 ft. wide to be erected over the creek at Market St. Estimated cost is $55,000, of which two traction companies will pay $30,000.

Railroads

Items Arranged Alphabetically by States.

Birmingham, Ala.—Birmingham, Mississippi & Southwestern Ry. is reported to be making good progress with the preliminaries for the construction of its road. The company was chartered with capital stock of $5,000,000 to construct a line from Birmingham, via Hattiesburg and Waynesboro, Miss., to Baton Rouge, La., with a branch from Waynesboro to Pascagoula. J. J. Comer and A. J. Hackett, Jackson, Miss., are interested.

Bessemer, Ala.—Advices from this place state that the Atlanta, Birmingham & Atlantic R. R. will probably purchase the South Georgia & West Coast Ry., which operates a line between Adel, Ga., and Perry, Fla., and will extend the Tampa Northern Ry. from Dunnellon, Fla., to Perry to a connection with it. The project also includes the construction of a connecting link from Adel to Tifton. Alex. Bonnyman, Atlanta, Ga., is Chief Engineer A. B. & A. R. R.

Kensett, Ark.—Missouri & North Arkansas R. R., W. S. Dawley, Chief Engineer, St. Louis, Mo., has let a contract for 650,000 cu. yds. of side borrow and three miles of pile trestle on 28 miles of its extension from this place to Cotton Plant, Ark. Contractor's name not stated.

Oakland, Cal.—E. A. Heron, Oakland, President of San Francisco, Oakland & San Jose Ry., has applied to the Board of Supervisors for a franchise for the construction of a railroad from near the Southern Pacific station at Melrose to the lower end of High St.

San Diego, Cal.—It is expected that the Rendle-Fraser Construction Co. will have completed by Dec. 15, the first 4,000 ft. of roadbed for the San Diego & Arizona R. R. This is the first construction contract for the railroad which is to connect this city and Yuma, Ariz.

Sandpoint, Idaho.—The Portland & Seattle R. R., a Northern Pacific project, according to reports from Spokane, Wash., is to be extended 69 miles from that city to Sandpoint, where the terminus of the line will be built and the shops established.

Baltimore, Md.—Mr. Walter B. Brooks, Jr., President of the Canton Co., has announced that his company will begin at once the completion of the railroad projected across the property of the company in and adjacent to Canton, comprising in all about 1,500 acres.

St. Louis, Mo.—Terminal Railroad Association of St. Louis will commence work shortly, it is stated, in the enlargement of its terminals in this city. The expenditure of at least $4,000,000 in improvements in the next few months is contemplated. W. S. McChesney, Jr., St. Louis, is President and General Manager.

Pilot Rock, Ore.—Oregon R. R. & Navigation Co., G. W. Boschke, Chief Engineer, Portland, Ore., is said to be considering extending the Umatilla Central many miles along the farming district up Birch Creek.

Bellaire, O.—Pennsylvania R. R., is said to be planning the construction next year of a second track on the Cleveland & Pittsburg Division of the Pan Handle from Bellaire to Mingo Junction, O., and the construction of a large freight yard at New Cumberland Junction, W. Va. Thos. Rodd, Pittsburg, Pa., is Chief Engineer.

Youngstown, O.—Baltimore & Ohio R. R., is to commence work next spring on the construction of its freight terminal in this city. Work includes extension of retaining wall, erection of two large freight houses and laying of 40 additional tracks. A. M. Kinsman, Baltimore, Md., is Engineer of Construction, B. & O. R. R.

Honesdale, Pa.—Delaware & Eastern R. R., O. F. Wagonhurst, Chief Engineer, Downsville, N. Y., is having surveys made for its line between Equimunk and Honesdale. The line will cross Wayne County, touching at Ariel and going by way of Moscow to Wilkesbarre. It is expected that grading work will be commenced soon.

Chattanooga, Tenn.— Alabama Great Southern R. R. will award contracts shortly for the construction of two miles of double track main line, paralleling the present track of the Belt railway from the new line of the Stevenson extension of the Southern Ry. to Hooke St. The present track of the Belt railway will also be straightened. J. H. Nelson, Chattanooga, Tenn., is Superintendent of Terminals.

Ballinger, Tex.—Ballinger & Abilene R. R. Co. has applied for a charter and proposes to construct a line 53 miles long between Ballinger & Abilene. According to advices from this city it was hoped to commence construction work by Dec. 15. The officers of the company are: C. A Doose, President; John I. Guion, First Vice President; J. W. Powell, Second Vice President; Tom Ward, Third Vice President; Jack McGregor, Secretary; Jo Wilmeth, Treasurer; W. J. McDaniel, Chief Engineer; C. O. Harris, General Attorney.

San Antonio, Tex.—Advices from this place state that the Nueces Valley Rio Grande & Mexico R. R. has been reorganized, and that the work of construction is to be begun soon. The road is to be built from a point north of Cotulla to Carrizo Springs. Some of the grading was done by the old company. The new officers of the company are: Asher Richardson, Oak Grove, President; T. Bivins, Pearsall, Vice President; Frank Fanning, San Antonio, Second Vice President; S. D. Chamberlain, San Antonio, Third Vice President and General Manager; Felix Shaw, San Antonio, Treasurer; T. E. George, San Antonio, Secretary.

Spokane, Wash.—Northern Pacific Ry. has made proposition to City Council by which it proposes to elevate its tracks through the city at a cost of $2,000,000. T. H. Croswell, Spokane, is Principal Assistant Engineer.

Olympia, Wash.—Northern Pacific Ry. has filed notice with Secretary of State of its intention to extend its Moclips branch 10 miles on the Quinault Reserve. T. H. Croswell, Spokane, Wash., is Principal Assistant Engineer.

Tacoma, Wash.—Dibble & Hawthorne, Contractors, have commenced grading at this city on the Union Pacific Main line extension from Portland to Tacoma, and it is announced that the contractors will have 40 miles of the road completed, so far as grading, bridge building and making ready for the ties and steel is concerned, within one year. This 40 miles of grading will reach from Tacoma to within a mile and a quarter of Centralia.

Madison, Wis.—The Wisconsin State Railroad Commission has granted the Lake Superior & Southern Ry. permission to issue 5 per cent fifty-year bonds to the extent of $9,000,000 face value. The company proposes to build a line from Huron, Mich., to Champion, Mich.

Wheeling, W. Va.—Wabash R. R. is said to be considering plans for double tracking its Wheeling & Lake Erie branch.

Cheyenne, Wyo.—The Wyoming Short Line Ry. Company has filed articles of incorporation. Its capital stock is $2,500,000 and it proposes to build a line of railway 50 miles in length, starting at Wiley and extending to the eastern edge of the Yellowstone National Park. The company is financed by the Big Horn Development Company, which is constructing the Oregon basin irrigation works, in the Big Horn basin.

Vancouver, B. C.—Advices from this city state that by next midsummer all the contracts would be awarded for the construction of the Grand Trunk Pacific Ry. from Edmonton to the Pacific seaboard at Prince Rupert. Tenders have just been called for at Montreal for the construction of the first 120 miles of the line west of Edmonton. Tenders will close for this section on Dec. 23, and immediately after that there will be awarded contracts for 125 more miles of line, which will dispose of the part west as far as the summit of the Yellowhead Pass. After that tenders will be called for construction, section by section, as far as the Coast, a distance of 400 miles, and if present plans are carried out all should be under contract by July.

Electric Railways.

Items Arranged Alphabetically by States.

Quincy, Cal.—Citizens of this place have subscribed $13,000 toward the construction of an electric or steam railway between this place and the Hartwell Ranch, 3½ miles distant, on the Western Pacific Ry. It is estimated that the grading will cost about $12,000 and the track about $18,000, the total cost being about $30,000 for grading and track, including bridges and culverts, but not the right of way or the necessary buildings.

Denver, Colo.—Thomas B. Doan, Assistant Manager of the Denver Union Water Co. has organized a company to acquire the Denver, Lakewood & Golden Ry. The organization contemplates a $750,000 bond issue. Of this amount about $400,000 will be necessary for the purchase of the property and terminals of the Denver, Lakewood & Golden. About $50,000 more will be used to extend the trolley line from the city limits to Golden. In addition two other branch lines may be constructed and ultimately the road extended to Colorado Springs.

Gillespie, Ill.—Construction of an electric railway from this place to some mines nearby is contemplated.

Boise, Idaho.—A company to be known as the Idaho & Nevada Southern Ry. Co. is to be incorporated, and proposes the construction of an electric railway from Jerome to Wells, Nev., a distance of 127 miles. Surveys for the road have been completed between the two terminal points. The company is to have a capital stock of $500,000, and the parties back of the project are interested in large irrigation projects near Twin Falls. The officers of the company are: H. L. Hollister, Chicago, Ill., President; I. B. Perrine, Vice President; R. M. McCollum, Secretary and Treasurer.

Decatur, Ind.—Necessary capital is stated to have been secured to assure extension of Fort Wayne & Springfield Ry., from Decatur to Boone, 12 miles. Estimated cost of extension is $200,000. W. H. Fleddeyahann, Decatur, is President.

Frankport, Ind.—Practically all of the right of way for the Frankfort, Delphi & Northern Interurban has been secured and some work has been done on grading the line between Frankfort and Rossville. The company has been reorganized, the officers now being as follows: Abe Straus, Chicago, Ill., President; W. H. Cohee, Frankfort, Ind., Vice President and General Manager; W. H. Cohee, Frankfort, Ind., Treasurer; Charles E. Hyman, Chicago, Secretary.

Muncie, Ind.—Logansport & Muncie Traction Co., A. M. Jenkins, Chief Engineer, will soon ask bids for construction of an electric railway between this city and Logansport.

Iola, Kan.—Surveys have been completed and necessary right of way secured for the Kansas Southern Electric Ry. and a press report from this place quotes F. V. Crouch, President, as stating that actual construction work would be started in the spring.

Ardmore, Okla.—Preliminary surveys are to be started at once for the projected electric railway, franchise for which is controlled by Donald Fitzgerald, New York City.

Portland, Ore.—Portland, Eugene & Eastern Ry. Co., with capital stock of $1,000,000, has been incorporated and proposes to build an electric road from Portland to Salem, Eugene, Yaquina, Prineville and Ontario, with branches to numerous towns. The total mileage contemplated is in excess of 800 miles. It is proposed to develop from the Mackenzie, the Santiam and the Deschutes Rivers and streams in central Oregon the power necessary for operating the system planned. John McNary, Salem, Ore., A. Welch, E. M. Hall, J. O. Story and J. C. Bracher, the last two said to be from Chicago, Ill., are among the incorporators. Franchises have been secured in Albany and Salem by A. Welch.

Enterprise, Ore.—Citizens of this place are organizing a company to build an electric railway to the proposed electric line from Walla Walla.

Emaus, Pa.—Allentown & Reading Traction Co. has been petitioned by citizens of this place to extend its lines into Emaus.

Johnstown, Pa.—Johnstown Passenger Ry. Co., Evan M. du Pont, Superintendent, proposes to build several miles of new track here and two new bridges.

Charleston, S. C.—Charleston & Summerville Electric R. R. Co. has been recognized and it is now said that the road will be completed. The route of the road between Charleston and Summerville has been graded with the exception of a few miles and already arrangements have been made for the prosecution of this short span. George Tupper, Summerville, S. C., is interested.

Greenville, S. C.—Surveys are now under way for proposed line of Greenville Interurban Co. from this place to Spartansburg, and necessary arrangements for financing the construction are said to have been made. John C. Carey is President and C. C. Good is Secretary. R. L. Scott of the engineering firm of Lockwood, Green & Co., 93 Federal St., Boston, Mass., is also interested.

Verblen, S. Dak.—Company has been organized here by E. A. Movins and J. H. Movins of Lidgerwood, N. Dak., and B. P. Hammerstad, Aaron Anderson, Ole P. Ayre, J. B. Holsey, H. J. Hanson, P. L. Peterson and George F. Anderson for the construction of an electric railway between this place and Lidgerwood. Press reports state that arrangements are to be made at once to secure an engineer to make surveys and estimates of cost.

Covington, Tenn.—Rights of way are being secured here for the Memphis, Covington & Northern R. R. It is understood that this road, the Clarksdale, Covington & Colliersville Interurban Ry. and the Lake View Traction Co. will be consolidated. The charter of these companies gives them the right to operate with any motive power except steam or animal. W. E. Willett, Memphis, Tenn., is General Manager, Lake View Traction Co.

Austin, Tex.—Committee, A. J. Eilers, Chairman, has been appointed to solicit funds to build an interurban from Austin to Lockhart to connect there with the Katy and San Antonio & Aransas Pass.

Sherman, Tex.—Financial arrangements are stated to have been completed so that construction work can be started shortly on the Gainesville-Whitesboro-Sherman Interurban, of which John King, Gainesville, Tex., is General Manager.

New Westminster, B. C.—According to advices from this place the British Columbian Electric Ry. Co., will at once let contracts for grading and construction work on the New Westminster-Chilliwack tram line. The line when completed will be 62½ miles long, and will tap New Westminster, Delta, Surrey, Langley, Matsqui and Chilliwack. W. H. Keary, New Westminster, is a Director, and R. H. Sperling is General Manager.

Electric and Gas Plants.

Items Arranged Alphabetically by States.

Fairfield, Cal.—E. D. Lehe, Dixon, Cal., proposes to build power line up Suisun Valley from substation near Cordelis to supply electricity.

Hollister, Cal.—The Hollister Light & Power Co. is planning to enlarge its electric light plant.

Long Beach, Cal.—The Edison Electric Light Co. will expend about $100,000 for a new plant at Long Beach.

Oakland, Cal.—The Western Power Co. is preparing to erect a large plant in East Oakland.

Des Moines, Ia.—Recently reorganized Central Heat & Power Co. will shortly begin work on construction of a central heating plant. W. H. Schott, Chicago, Ill., is interested.

Ida Grove, Ia.—Ida Grove Electric Co., recently granted 15 year franchise for lighting and heating, will improve its plant.

Pella, Ia.—W. H. Fowler and H. J. Rhynsburger have purchased the electric light plant.

East Moline, Ill.—Harry D. Swartz, Manager of the Central Union Telephone Co., and Chas. E. Knorr, representing Electric & Gas Heating & Lighting Co., have asked for a 20 year franchise to furnish street lights for the city.

Midway, Ky.—Franchise for establishing and maintaining an electric lighting and power system in this city has been purchased by the Versailles Electric Light Co.

Escanaba, Mich.—Common Council has accepted the contract proposed by the Escanaba Electric Pulp & Power Co. to furnish power for the operation of the municipal lighting plant for a period of ten years.

Pender, Neb.—M. M. Neumann proposes to put in electric plant here if he can secure 15 year franchise.

Cambridge, O.—Cambridge Power, Light & Traction Co. is to increase its power plant equipment.

Cedarville, O.—The Cedarville Light & Power Co. has been incorporated. L. H. Sullenberger, B. F. Siegler and O. L. Smith are interested.

Cuyahoga Falls, O.—Falls Rivet & Machine Co., Edwin Seedhouse, Manager, according to reports, proposes to erect small power plant.

Pitcairn, Pa.—Borough Council has authorized issue of $15,000 electric light, street improvement and sewer bonds.

Mitchell, S. Dak.—Local parties have been granted 20 year franchise and will take over the holdings of Mitchell Gas Co. and will erect an electric plant.

Limestone, Tenn.—Installation of electric light plant here is contemplated by W. N. Mitchell.

McKinney, Tex.—City has voted to issue $26,000 of bonds, part of which will go for extending electric light system.

Salt Lake City, Utah.—Mayor Bransford has receved a proposition from the Utah Light & Railway Co. to install 1,000 arc lights at a cost of $60 per light per year, bringing the cost annually to $60,000. The present arrangement with the Utah Light & Railway Co. is for 588 lamps at a cost of $42,336 per year.

Richmond, Va.—The Richmond Light, Heat & Power Co. has made a proposition to purchase the municipal light and power plant.

Sewers.

Items Arranged Alphabetically by States.

Des Moines, Ia.—George Dobson, City Engineer, has submitted to City Council tentative plan for combining all city sewers into a large trunk sewer with an outlet into the Des Moines River two miles south of the forks of the Raccoon and Des Moines Rivers. Cost of work would be about $75,000.

Paris, Ill.—Property owners on north side of city are petitioning Board Local Improvements to establish new sanitary sewer district in that section.

Muncie, Ind.—Board of Works has approved plans of City Engineer Potter for sewer in the west end, leading down Jackson St. from Kilgore Ave. and terminating at south bridge abutment.

Joplin, Mo.—Council has passed ordinance calling for an election to vote on issuing $96,000 of bonds for building storm and sanitary sewers.

Kansas City, Mo.—Board Public Works, Everett Elliott, Secretary, has practically decided to employ an expert sanitary engineer to make a detailed plan for a complete sewer system for the city. The Board is also considering the advisability of creating a sewer department with engineers detailed from the city engineer's office to construct all new sewers after the plans furnished by the expert.

Springfield, O.—City Council has passed ordinance for construction of system of 8-in. connecting drains in Mechanic and other streets.

El Reno, Okla.—City Engineer has prepared plans and specifications for sewer extensions and bids for the work will be asked shortly.

Butler, Pa.—State Health Department has issued permit to this Borough requiring it to arrange for disposal works, sewage now being discharged into river.

Bedford, Pa.—State Health Department has granted this place permit to extend its sewers but requires that surveys be made for complete system.

Canonsburg, Pa.—Council has asked permit from State Health Board to allow South Canonsburg to have outlet for its sewers into Chartiers Creek.

Chartiers, Pa.—This Township has been granted leave to discharge sewers into Chartiers Creek. Matter of sewage disposal, however, must be taken up.

Erie, Pa.—Plans are being made for intercepting sewer for 19th St.

Harrisburg, Pa.—Council has approved ordinances for construction of three sewers.

Kutztown, Pa.—State Health Department has advised this Borough that it must provide itself with a method of disposing of its sewage, on account of the danger of contaminating the water supply of Reading.

Lancaster, Pa.—Bids are to be asked early next year for constructing new sewers.

Scalp Level, Pa.—This Borough has been granted leave to build sewers to temporarily empty into a mine run.

Taylor, Pa.—Borough is to improve its sewer outlets.

Wilkesbarre, Pa.—Sewers are to be constructed in Cedar St.

Cameron, Tex.—Surveys and estimates are being made for sewer system for this city. Bond issue for construction will be voted on.

Water Supply.

Items Arranged Alphabetically by States.

El Dorado, Ark.— Improvement District No. 1, R. N. Garnett, Chairman, will expend $35,000 for improving water works. M. P. Jackson is Engineer.

Johnstown, Colo.—A $20,000 bond issue for installing water works has been voted.

Camaguey, Cuba.—Henry A. Young, Jefatura de Obras Publicas, Camaguey, Engineer in Charge of Water Works, advises us that the Director General of Public Works of Cuba, has definitely decided that the pumping plant for the new $800,000 water works for this city shall be a steam plant using wood for fuel. Two units of about 150 HP. capacity, pumping 1,075 gallons per minute against a head of 365 ft. will be required. Compound engines with condensers, and water tube boilers will probably be used.

Palmetto, Fla.—This place has voted to issue $10,000 of water works bonds.

Twin Falls, Idaho.—Twin Falls Salmon River Irrigation Co. has applied for incorporation and proposes to reclaim 190,000 acres of land in Southern Idaho; the company is to have capital stock of $500,000. The project includes the taking of water from Salmon River, the construction of a dam, and the boring of a tunnel 3,000 ft. long. About $2,500,000 will be expended it is stated. Those interested are I. B. Perrine, H. L. Hollister, Chicago, Ill., Robert McCullom, C. B. Hurtt and George Sprague.

Strawberry Point, Ia.—Town Council proposes to secure auxiliary engine for water works.

Rockton, Ill.—Water works to cost about $17,000 are proposed for this place.

Elkhart, Ind.—Plans for water works here are being prepared.

Hancock, Md.—Plans for water works, to include reservoir, for this place, have been prepared by Arthur Giesler, Engineer, Dayton, O.

Grand Rapids, Mich.—A $150,000 bond issue may be voted on at next city election for purchase of new 12,000,000 gallon pump and for general repairs to water works system.

Manistique, Mich.—Board Public Works has voted to install additional pump at city water works station.

Vicksburg, Miss.—Village of Speeds Addition voted Dec. 2 to install water works.

St. Louis, Mo.—Water Department will shortly take up matter of installing high pressure fire system in business section of city. Cost will be between $1,500,000 and $2,000,000.

Benson, Neb.—A $9,000 bond issue has been voted for improvement of city water works.

Verona, N. J.—Borough Council has recommended expenditure of $55,000 for establishing water works.

Syracuse, N. Y.—Bids are to be asked shortly for furnishing city with 20,000 tons of 30-in. iron pipe, which is to be used next year in the construction of the second conduit line from Skaneateles Lake to this city to provide for an auxiliarly water supply. Henry C. Allen is City Engineer.

Lockport, N. Y.—City has accepted the water franchise granted by the Common Council of North Tonawanda permitting Lockport to lay water mains in certain streets in that city.

East Liverpool, O.—Council has adopted ordinance granting franchise to Crystal Springs Water Co.

Lebanon, Pa.—Council has passed ordinance appropriating $3,000 for survey of Fishing Creek water supply.

Pittsburg, Pa.—This city, according to press reports, is to secure expert to assist in proceedings for the purchase of the plant of the Monongahela Water Co. George H. Benzenberg, Milwaukee, Wis., has been engaged as chief expert at $100 per day. A. B. Shepherd is Director of Public Works.

Fairchance, Pa.—City has voted to issue $20,000 of bonds for water works.

Pittsburg, Pa.—I. N. De Noon, Pittsburg, has asked charter for the Risco Water Co. of Crescent Township, Allegheny County.

Progress. Pa.—Progress Water Co. has been chartered. B. F. Ober, Harrisburg, Pa., is Treasurer.

York, Pa.—York Water Co. is seeking state approval of an increase of stock of $1,500,000.

Columbia, S. C.—Council Water Works Commission proposes to expend $12,000 to lay double 8-in. main along Main St. Plans have been completed by City Engineer Chisholm.

Dallas, Tex.—City has voted $30,000 of water works and sewer bonds.

McKinney, Tex.—A bond issue of $26,000 for providing a city park and extending the water works and electric light system has been voted.

Corliss, Wis.—Establishment here of combined water works plant and electric light system is under consideration.

Cheyenne, Wyo.—A $160,000 bond issue for water works improvements has been voted.

New Westminster, B. C.—A new reservoir to cost about $25,000 is to be constructed for this city.

INDUSTRIAL NOTES

Allis-Chalmers Co. of Milwaukee has been awarded the gold medal for electric generators and motors, issued by the authorities of the Jamestown Exposition, as determined by a jury of well known technical experts representing leading electrical interests of the country. A second gold medal has also been granted for the good judgment and taste shown in the design and erection of the exhibit, which has been one of the most attractive features of "Machinery Hall." Gold medals have previously been taken by electrical apparatus of this company's build at the Louisiana Purchase Exposition, Paris Exposition, and other exhibitions where there was international competition.

The Blanc Stainless Cement Co. has recently placed in operation in Allentown, Pa., a plant for the manufacture of its product. The cement, which is the result of a number of years of study and experimenting by Mr. J. Maxwell Carrere, Treasurer and General Manager of the company, is said to have as much strength as Portland cement and to be immaculate in color. The plant is electrically operated throughout.

The Expanded Metal & Corrugated Bar Co.'s product, the Johnson corrugated bar, has been awarded the gold medal by the Jury of Awards of the Jamestown Exposition. This is the fourth gold medal that the corrugated bar has been awarded, the last one having been given at the International Exhibition at New Zealand.

The Alpha Portland Cement Co. of Easton, Pa., has voted to increase the capital stock of the company from $2,000,000 to $6,000,000. The increased stock will be held in the treasury to be used in the business as required.

The Cement Products Exhibition, Co., which is to hold its first annual cement show at the Coliseum in Chicago, Ill., on Dec. 17-21, has announced that the Northwestern Cement Products Association will hold its annual convention in Chicago on Dec. 18 and 19. Meetings of this Association will take place in the second floor of the Coliseum Annex and will be in charge of the officers of that Association. The officers of the Northwestern Cement Products Association are as follows: President, Lee Stover, Watertown, S. D.; Vice-President, O. U. Miracle, Minneapolis; Vice-President, Wm. Simpson, Mandan, N. D.; Vice-President, C. A. P. Turner, Minneapolis; Vice-President, A. H. Laughlin, Lisbon, N. D.; Vice-President, John Wunder, Minneapolis; Secretary, M. T. Roche, St. Paul; Treasurer, J. M. Hazen, Minneapolis.

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RAILWAY WORK.

The J. H. Reynolds Construction Company, successors to J. H. Reynolds, have secured the contract for 150 miles of work in northern Ontario and Quebec, Canada, and will be ready to let the work soon after December 1st, 1907. The work consists of grading (earth and rock, principally earth), mostly steam shovel work to be done with small cars and track, and also concrete work and tie contracts. Address The J. H. Reynolds Construction Company, McDougall Chutes, Ontario, Canada. 23-2t

U. S. ENGINEER OFFICE, Portland, Oreg., Nov. 20, 1907. Sealed proposals for construction of one stern wheel steamboat will be received here until 11 A. M., Dec 20, 1907, and then publicly opened. Information furnished on application. S. W. Roessler, Lt. Col., Engrs. 21-4t

SEALED PROPOSALS will be received at the office of the Light-House Engineer Tompkinsville, New York, until 1 o'clock p. m., Dec. 16, 1907, and then opened, for furnishing two fourth order lanterns for Honolulu Range Light-Stations, Hawaii, in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to the Light-House Engineer, Tompkinsville, N. Y. 21-3t

U. S. ENGINEER OFFICE, Portland, Oreg., Nov. 23, 1907. Sealed proposals for construction of one wooden hull hydraulic dredge will be received here until 11 a. m. Dec. 23, 1907, and then publicly opened. Information furnished on application. S. W Roessler, Lt. Col., Engrs. 22-3t

READVERTISEMENT.

LAYING WATER PIPE.

Phoenix, Arizona.

Sealed proposals will be received by the Superintendent of the Water Department at the City Hall, Phoenix, Arizona, until four o'clock of January 10th, 1908, for laying cast iron water pipe.

A certified check for five per cent of the amount of the bid, made payable to Frank Thomas, City Recorder, must accompany each proposal.

Specifications may be obtained upon application.

The Superintendent reserves the right to reject any and all bids, and to waive any informalities in any proposal.

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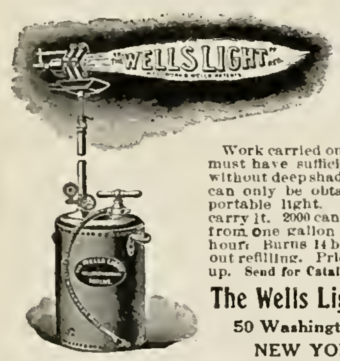

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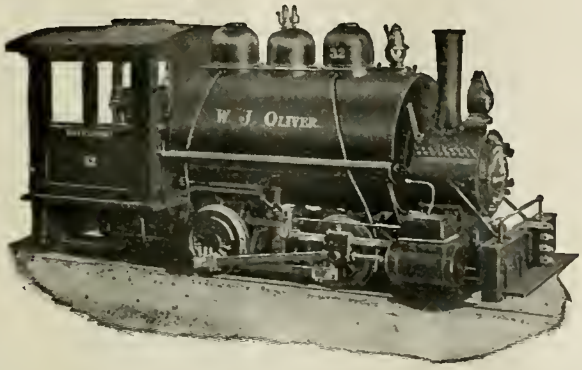

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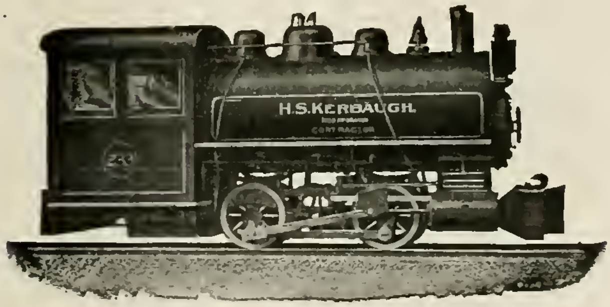

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An Abuse of Those That Use Cost Data

An editorial that recently appeared in the columns of *Engineering Record* is entitled "The Abuse of Cost Data." The title is a misnomer. It is an "abuse" editorial, it is true, but the abuse is heaped on those that use cost data. The stand is unequivocally taken by our contemporary that published cost data are without value, or practically so, for we read: "The likelihood is that, after all, they (cost data) will be safely useful only to the men connected with the work on which they were made."

In other words, published cost data are almost certain to be valueless, or worse than valueless. If ever a statement with longer ears and a louder bray has stalled itself in the columns of an engineering journal it has escaped our attention.

What are cost data? Wherein do they differ so completely from all other records that they possess value only to the recorders? Answering the first question, we may define cost data as being records showing itemized quantities of materials and of labor required to produce a specified structure or a specified amount of work.

When a careful observer has ascertained that the boiler of a 10-ton steam roller consumes 0.35 ton of anthracite coal per 10-hour day when working continuously on a road or street, that observer has secured *some* cost data on the construction of a road which may be used as an element in predicting the cost of another road. When two, three, or four observers have secured similar data on coal consumption on different roads, and when they differ less than 10 per cent from this 0.35 ton per day, and then differ on the side of safety by being less than 0.35 ton, it is clear to any sane mind that this much as to the cost of road construction is at least trustworthy.

Going a step farther, when it is recorded that only one man is needed to run such a roller, we have the largest element of labor definitely ascertained. When the cost analyst has ascertained that the annual maintenance and renewal cost of a $2,500 roller has averaged $150 per year for an average working season of 100 days actually worked, another important item of cost is definitely known. And when the experience of several different recorders shows that in no typical case had this $150 item been exceeded, there is evidence amounting to a certainty that an allowance of 0.06 per cent of the first cost of the roller per day actually worked will cover maintenance and renewals.

If the observer has recorded each of the other items, and has checked them by the records of other observers, and has thus secured a total daily cost of operating and maintaining a roller, he needs only to know its average daily output of units of useful work to be able to estimate with great accuracy the cost per unit for rolling. Having kept records on several roads, showing that 40 cu. yds. of macadam rolled per 10-hour day is an output easily secured and usually exceeded, the recorder can then calculate the unit cost of rolling with an accuracy that amounts to a mathematical certainty, assuming only an ordinary amount of managerial ability on the work. Indeed, in the work of designing the average engineering structure, there is infinitely more guesswork than in estimating its cost—*provided the engineer who makes the estimate is a skilled recorder and interpreter of itemized cost data.*

To this it will be replied by those that abuse the users of cost data, that we should not have cited such simple and well known data as road rolling costs, but should have selected some cost about which there is less knowledge and therefore more dispute. It is true that these cost facts as to rolling are now generally known and pretty generally accepted as conservative, but, until a certain book was published a few years ago, they were not generally known, and there were, indeed, very few engineers who knew anything about them at all. The published observations of other engineers have subsequently served to confirm these cost data on road rolling, and have shown that they form the basis for conservative estimates of similar costs.

In precisely the same manner the cost data that this journal is publishing are either confirming previously published data, or putting new data on record as a guide for men now wholly or partly ignorant of costs.

Must we assume that a man must wait until he has gathered costs by his own observation before he can make a trustworthy estimate of a class of work in which his experience is small? Not by any means. Cost data differ in no radical respect from innumerable kinds of data that form the basis for scientific action. Who is there so childish as to deny the logical right to use the results of tests on the breaking strength of white pine, made by the Department of Agriculture? Who will contend that I should restrict myself to the use of those coefficients of sliding friction which I have recorded myself, and that all others are almost certain to lead me into grave error? Wherein does my use of published coefficients of friction differ from my use of published cost data? There is not one whit of difference. *In both cases I must study the data in the light of the conditions recorded in the publication.* In both cases I shall err, if at all, only in my interpretation of those conditions or through failure to find them recorded in sufficient detail.

Cost data, therefore, are no more subject to incorrect application than countless other data which engineers use daily with the greatest feeling of confidence. It is true that cost data must often be applied with unusual care, and that, where serious doubt still exists, a liberal margin for contingencies must be added. But this statement is widely different from that made in *Engineering Record*, wherein estimating by cost synthesis is utterly condemned.

The *Record's* editorial writer has other ideas about cost analysis—ideas indicating

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either a studied misconstruction of the claims made for cost analysis, or a misdirected study of those claims. In the closing sentence of the editorial an attempt is made to ridicule cost analysis by comparing it with an effort to ascertain the cost of making a drawing by first ascertaining the cost of the lead pencils used.

In almost every work there are certain items of cost so small that they are best grouped together under some general head, like general expense, and treated subsequently as a precentage of the total cost; but frequently it pays to keep careful record of certain of these minute items. There are many firms that have most carefully kept data as to the cost of postage stamps, for example, and of other salable office specialties; the purpose being to discover either theft or waste. So, the *Record's* ridicule of a cost analysis showing the cost of lead pencils is weak enough from this point of view. It is equally weak if intended to apply to a cost analysis that extends so far as to include the careful timing of the hourly operations of men and machines. Such timing is made primarily to ascertain ways of *reducing* costs, and not for the purpose of *predicting* costs, although it often serves both purposes admirably. Thus, by the timing of men engaged in using rock drills, it is possible to discover previously unperceived causes of delay which can be remedied. And the same timing also discloses means of predicting the cost per foot of drilling holes of different depths—costs that would have to be guessed at without such timing. *Engineering Record,* in common with others who are ignorant of modern cost analysis, forgets to consider that the same man who makes a careful and minute analysis of costs covering short periods of time also makes similar analyses covering long periods of time, and that, while he uses the short time analysis principally to ascertain how to *reduce* existing costs, he uses the long time analysis to *predict* future costs.

When a man confessedly ignorant of cost analysis undertakes to write in defense of his own ignorance and in extenuation of a similar ignorance in others, his task is one that must excite either amusement at his efforts or pity for the purility that actuates them.

The construction of the new line of the Panama railroad will necessitate the building of an embankment at Gatun, 1¼ miles long. The average height of the embankment will be 82 ft. and it will contain 2,600,000 cu. yds. of material. It is planned to build the fill in three sections. A trestle 30 ft. high and running the entire length of the fill will first be built, from which material will be dumped by the construction trains. When the dirt reaches the top of the trestle another 30-ft. trestle will be built on the dump thus formed, and the operation will be repeated until the final grade of the railroad is reached.

Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Hoist and Car Plant for Mixing and Placing Concrete for a 30-Span Arch Viaduct.

A combination of bucket hoists and cars was sucessfully used recently in constructing a long concrete arch viaduct for the Union R. R. at Pittsburg, Pa. The contractors were the McKelvey-Hine Co., of Pittsburg, Pa., and we are indebted to them for the information given.

The double track concrete viaduct replaced a single track steel viaduct, being built around and embedding the original steel structure which was maintained in service. The concrete viaduct consisted of 21 spans of 26 ft., 7 spans of 16 ft., and 2 spans of 22 ft. With piers it required about 15,000 cu. yds. of concrete. Two Ransome concrete hoists, one on each side of the original steel structure near one end, were supplied with concrete by a No. 4 Ransome mixer. The mixer discharged direct into the bucket of one hoist and by means of a shuttle car and chute into the bucket of the other hoist.

The shuttle car ran from the mixer up an incline laid with two tracks, one narrow gage and one wide gage, having the same center line. The car was open at the front end and its two rear wheels rode on the broad gage rails and its two forward wheels rode on the narrow gage rails. At the top of the incline the narrow gage rails pitched sharply below the grade of the broad gage rails so that the rear end of the car was tilted up enough to pour the concrete into a chute which led to the bucket of the hoist. The sand and gravel bins were elevated above the mixer and received their materials from cars which dumped directly from the steel viaduct.

The hoist buckets discharged into two hoppers mounted on platforms on the old viaduct. These platforms straddled two narrow gage tracks, one on each side of the old viaduct parallel to and clearing the main track. These side tracks were carried on the cantilever ends of long timbers laid across the old viaduct between ties. At street crossings the overhanging ends of the long timbers were strutted diagonally down to the outside shelf of the bottom chords of the plate girder spans. Six cars were used and the concrete was dumped by them directly into the forms; the fall from the track above being in some cases 40 ft. The hoists and shuttle car were operated by an 8½ x 12-in. Lambert derrick engine, the boiler of which also supplied steam to the mixer engine. The concrete cars were operated by cable haulage by two Lambert 7 x 10-in. engines.

The labor force employed in mixing and placing concrete, including form work, was 45 men, and this force placed on an average 200 cu. yds. of concrete per day. Assuming wages we get the following costs of different parts of the work for labor above:

Item.	Per day.	Per cu. yd.
1 timekeeper at $2.50...	$ 2.50	$0.0125
1 general foreman at $5	5.00	0.0250
3 enginemen at $5......	15.00	0.0750
1 carpenter foreman at $4	4.00	0.0200
12 carpenters at $3.50...	42.00	0.2100
1 foreman at $4........	4.00	0.0200
8 men mixing and transporting at $1.75......	14.00	0.0700
13 men placing concrete at $1.75....	22.75	0.1137
1 foreman finishing at $4	4 00	0.0200
4 laborers finishing at $1.75	7.00	0.0350
45 men at $2.70.........	$120.25	$0.6012

It is probable that the carpenter work includes merely shifting and erecting forms and not the first cost of framing centers. No materials, of course, are included. It should be kept in mind that while the output and labor force are exact the wages are assumed.

During 1906 crushed stone valued at $17,467,486 was produced in the United States.

During the fiscal year ending June 30, 1907, there were 39 well or mechanical churn drills and 139 air drills in operation on the Panama Canal. The number of lineal feet of holes drilled was as follows:

	Lineal feet.
Steam and air drilling............	442,839
Well or mechanical churn drilling..	167,052
Hand drilling......................	100,101
Total	709,992

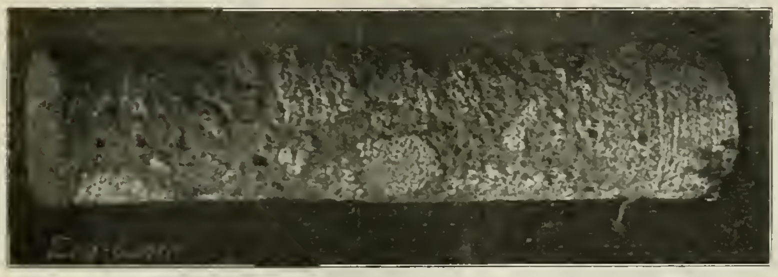
A total of 1,998,655 lbs. of dynamite and 408,385 lbs. of black powder was used during the year.

Sampling Concrete by Means of Shot Drills Operated by Hand.

BY B. G. COPE*.

In a great many instances where contracts have been completed on concrete work, the question arises as to whether or not the contractor has fulfilled the specifications in regard to mixture, etc., and the result is usually a long drawn out litigation. In a great number of cases the work is of such character that to determine whether or not the specifications have been followed is quite difficult. If the samples to be taken are to be of any value it is necessary to take them from various sections and from the interior as well. If the work is a heavy arch, wall or foundation, to dig a large hole into it would not only deface it, but would injure its strength, which would necessarily mean a considerable loss in money and time. The most practical method of sampling in such a case is to take out a core of the material with what is known as a Shot Drill.

These drills are made up in various sizes, but the small hand power outfits answer the purpose in practically every instance. A hole can be run into the concrete very rapidly, a core removed, analyzed, and the character of the mixture determined accurately. The holes do not injure the strength or appearance of the work. Samples can be taken at any depth desired. The writer does not know whether this method of testing concrete was original with the government, but it was used on the locks and dams on the Ohio river a few years ago, which was the first work of the kind he had seen. The photograph shows a section of a 1¾-in. core taken from the concrete on the government work.



Sample Core Taken from Concrete by Shot Drill.

This method of sampling, aside from being an absolute check on the contractor, also keeps a check on the inspector, who is placed in charge of the work, or saves the cost of an inspector altogether, as no contractor will wilfully deviate from his specifications knowing his work will be sampled and tested. It also gives the contractor an opportunity to prove beyond question that he has followed to the letter and leaves no room for doubt relative to the character of his work.

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*Orrville, Ohio.

Method and Cost of Lining a Section of the Gunnison Tunnel with Concrete.

The following account of concrete lining work on the Gunnison tunnel being built by the engineers of the U. S. Reclamation Service was sent out for publication some time ago. The data were lacking in some particulars but as we have so far been unable to secure the information that is lacking we present the matter as received, adding to it the figures necessary to show the costs per cubic yard in each case.

The costs given are for concrete in place in the side walls and the arch of the tunnel, for a length of 440 lin. ft. The quantity of concrete considered in estimating the cost per cubic yard was 616 cu. yds. The material was mixed and placed in ½ cu. yd. batches, the proportion of the mixtures being 1:2.2:4.4. The final cost includes the labor of excavating and screening gravel and sand, the hauling of the same from the bins at the pit to the storage bins at the main shaft, the care of the chutes in the shaft and the mixing of the concrete in the tunnel at the bottom of the shaft, the transportation of the concrete from the mixer to the traveler, the deposition of the concrete, the setting up and taking down of forms and the cost of the cement. It does not include the construction of the gravel pit chutes that hold the screens, the building of the road from the gravel pit to the storage bins at the shaft, the concrete mixer and its installation, the traveler and its installation, the cost of material and labor in the construction of the concrete forms, the requisite power to run the machinery and other expenses of a similar nature.

The gravel used for the concrete was obtained from a pit situated on top of a hill not far from the main shaft leading down to the tunnel. This gravel bed contains very closely the proper proportions of sand and gravel for the concrete aggregates. The gravel was excavated and loaded by hand into side dump cars of 35 cu. ft. capacity. These cars were run to the edge of the hill where the gravel was dumped upon a screen from which it ran by gravity, passing thence into storage bins. From the storage bins the sand and gravel were drawn off into dump wagons having a capacity of 2 cu. yds. and hauled a distance of one-half mile to a second set of storage bins located at the top of the shaft leading into the tunnel. The road from the storage bins at the gravel pit to the storage bins at the head of the shaft was down grade. A two-horse team could readily haul 2 cu. yds. of gravel over this road. The storage bins at the top of the shaft leading into the tunnel communicated with the measuring boxes at the bottom of the shaft by means of chutes. The measuring boxes discharged directly into tram cars. The average length of haul from the mixer to the place of deposition of the concrete was about 4,500 ft.

The concrete was placed in the side walls by means of a traveler, which was so operated in the tunnel as to allow the passage' of the concrete trains beneath it. The traveler was 64 ft. long and was provided with a slow motion electric hoist by which the cars containing the concrete were elevated to the top of the traveler and thence transferred to any desired position. The concrete was dumped from these cars into boxes where any remixing or tempering that was required was done, after which the concrete was shoveled directly into the forms. The entire operation of handling the materials of the concrete, it will be seen, utilized gravity to the greatest possible degree.

In order to get a good average cost per cubic yard for handling gravel and sand, this analysis has been based on five months' operation, from November, 1906, to March, 1907. In these five months there were 4,123 cu. yds. of sand and gravel handled. The concrete considered was placed during the month of March. Below is given the distribution of the cost of the concrete as to the specified divisions of the work and as to the class of work involved in each division. Measurements taken at the mixer show that each cubic yard of concrete contained 0.74 cu. yds. of gravel, 0.445 cu. yds. of sand and 5.6 sacks of Portland cement. The total of the aggregates is, therefore 1.185 cu. yds. per cubic yard of concrete. The cement costs $0.62 per sack on the work, making a cost of $3.472 per cubic yard of concrete.

Excavating and screening 4,123 cu. yds. gravel:

	Total cost.	Per cu. yd. gravel.
$3.04	$ 203.30	$0.049
Labor, 397½ days at $2.56.	1,017.60	0.247
Labor, 116¼ days at $2.08.	241.80	0.059
Total	$1,462.70	$0.355
Hauling 4,123 cu. yds. gravel and sand:		
2-horse tram and driver, 210 days at $360........	$ 756.00	$0.183
2-horse tram and driver, 4½ days at $4..........	18.00	0.005
Total	$774.00	$0.188

As there were 1.185 cu. yds. of gravel per cubic yard of concrete the cost of gravel per cubic yard of concrete was for:

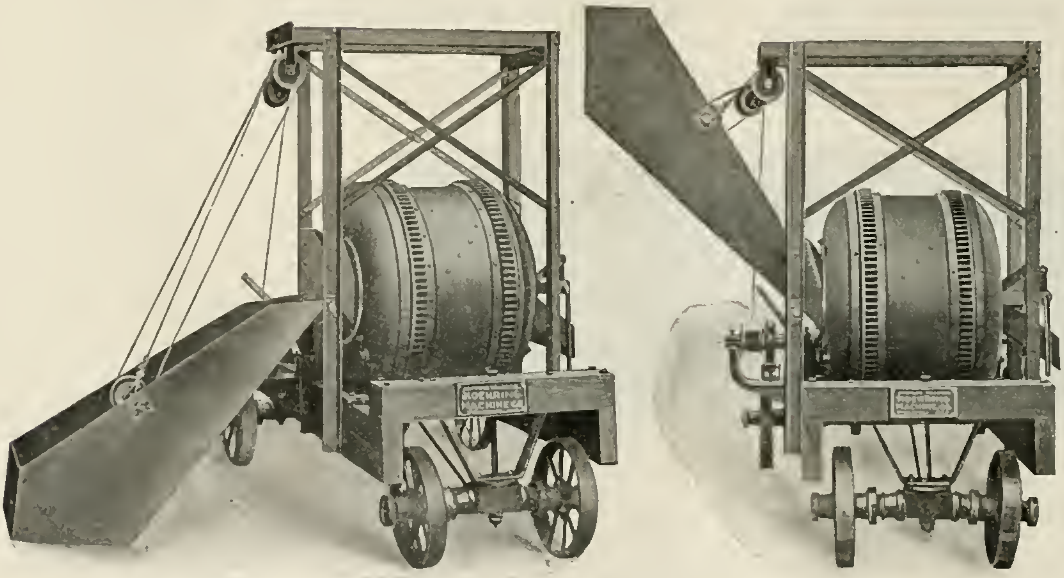
Excavating and screening (1.185 × $0.355)	$0.421
Hauling (1.185 × $0.188)	0.223
Total	$0.644

Adding to this the cost of cement $0.62 · 5.6 = $3.472, we have $0.644 + $3.472 = $4.116 as the cost of concrete materials per cubic yard of concrete. The cost of labor, mixing and placing was as follows for 616 cu. yds.:

Mixing 616 cu yds. concrete:	Total. cost.	Per cu yd. concrete.
Superintendent 2 days at $5.83⅓	$ 11.67	$0.020
Foreman 1 day at $4.50	4.50	0.007
Labor 45 days at $3.04	130.72	0.215
Labor 93 days at $2.56	238.08	0.381
Hoist engineer 34 days at $3.52	119.68	0.196
Total	$504.65	$0.819
Transporting 616 cu. yds. concrete:		
Superintendent 1 day at $5.83⅓	$ 5.83	$0.009
Foreman 1 day at $4.50	4.50	0.007
Motorman 34 days at $3.04	103.36	0.175
Brakeman 34 days at $2.56	87.04	0.135
Total	$200.73	$0.326
Depositing 616 cu. yds. concrete:		
Superintendent 4 days at $5.83⅓	$ 23.33	$0.038
Foreman 4 days at $4.50	18.00	0.029
Foreman 68 days at $3.04	200.72	0.333
Labor 238½ days at $2.56	610.56	0.993
Total	$858.61	$1.394
Setting and moving forms:		
Superintendent 2 days at $5.83⅓	$ 11.67	$0.018
Foreman 2 days at $450	9.00	0.014
Carpenter foreman 10 days at $5	50.00	0.080
Carpenter 13 days at $3.20	41.60	0.067
Labor 49 days at $3.04	148.96	0.241
Labor 19 days at $2.56	48.64	0.078
Total	$309.87	$0.498

Summarizing we have the following cost:

Materials:	
Cement, 5.6 bags at $0.62	$3.472
Gravel (excavating and screening)	0.421
Hauling gravel and sand	0.223
Total materials	$4.116
Labor:	
Mixing concrete	$0.819
Transporting concrete	0.326
Depositing concrete	1.394
Setting and moving forms	0.498
Total labor	$3.037
Grand total	$7.153



Elevating Charging Hopper Equipment for Koehring Concrete Mixer.

An Elevating Charging Hopper for a Concrete Mixer.

When the charging of a concrete mixer requires the construction of a platform and incline and the wheeling of sand, cement and stone up this incline the contractor can well afford to consider the use of an elevating charging hopper. The accompanying illustration shows such a hopper attached to a Koehring mixer. The simplicity of the device in both construction and operation is clearly shown. The hopper holds a charge for one batch and is charged by wheelbarrows, shovels or other means of loading material from the ground. When filled the operator throws a friction clutch tilting the hopper and emptying its contents into the mixer. No platform or incline is required, the edge of the charging hopper being only 12 ins. above the ground permits wheelbarrows to be emptied directly into it. The expense of building and running inclines and the extra cost of wheeling up inclines are thus both done away with. The Koehring mixer with elevating charging hopper is made by the Koehring Machine Co., and the general sales agents are the Chicago Builders' Specialties Co., Chicago, Ill.

Absorption Tests of Concrete Blocks With and Without Water-Proofing.

The blocks tested were 8 x 9 x 16 ins., composed of 1-4.8 by weight of Portland cement and limestone screenings. A portion of the blocks were made without admixture of water-proof compound, a portion had 1 per cent. and another portion had 2 per cent of "Medusa" water-proof compound. The untreated blocks weighed 60 lbs. each and the treated blocks weighed 62 lbs. each. All blocks were made alike and exposed to the weather for 9 months and then taken into the laboratory and allowed to become air dry. They were then placed in water for 24 hours; the water was 3 ins. deep and the blocks were removed and weighed at periods of 1, 2, 3, 4 and 24 hours. Two sets of experiments were made and the results are shown by the accompanying table. The tests were made by the Sandusky Portland Cement, Co., Sandusky, O.

Absorption, Per Cent. of Total Weight.

	Without Water-proofing.		1% Water-proofing.		2% Water-proofing.	
Experiment No.	1	2	1	2	1	2
1 hour	5.31	4.38	0.83	0.44	0.85	0.09
2 hours	6.20	4.84	1.24	0.44	0.85	0.09
3 hours	6.20	4.94	1.24	0.48	0.85	0.14
4 hours	6.64	4.99	1.24	0.54	1.27	0.14
24 hours	7.12	5.16	1.65	0.70	1.27	0.30

A total of 29,539,852 short tons of crushed stone was produced in the United States in 1906. Of this amount 10,011,550 short tons was used for road making, 10,355,322 tons for railroad ballast and 5,990,256 tons for concrete.

Exhibitions and Conventions of Interest to Concrete Users.

As this issue appears the first cement show of the Cement Products Exhibition Co. is being held in Chicago, Ill. In our next issue we shall give some account of the exhibits and of the technical proceedings of the show. These technical proceedings are being worked out in conjunction by the Cement Products Exhibition Co. and the Northwestern Cement Products Association, whose annual convention is being held at the place of the cement show and during two days, Dec. 18 and 19, of the exhibition. The program is a somewhat elastic one, but it includes talks by a number of well known engineers and cement technologists besides the following papers:

The Status of the Cement Industry in Iowa, by R. G. Coutts, Grinnell, Iowa.

Practical Suggestions for a Concrete Block Plant in a Small Town, by Ed. Smith, Barron, Wis.

Use of Concrete and Cement Block on the Farm, by Mr. Schuette or Mr. Murphy, Manitowoc, Wis.

The Effect of the San Francisco Earthquake and Fire on the Structures and Structural Materials, by Richard L. Humphrey, Philadelphia, Pa.

Reinforced Concrete, by T. L. Condron.

Vapor Curing of Concrete Blocks, by S. B. Newberry, Sandusky, Ohio.

Caps, Sills and Other Special Work, by Eugene Tusch, Minot. N. D.

Forms, by Earnest McCullough, Chicago, Ill.

Construction of Concrete Sidewalks, by C. O. Brainerd, St. Louis, Mo.

Manufacture of Cement Pipe, by Mr. Klemme, Belmond, Iowa.

General Uses of Cement Pipe, by L. L. Bingham, Estherville, owa.

The Use of Concrete and Concrete Pipe as Applied to Irrigation, by E. T. Perkins, Chief Engineer, Reclamation Service, Chicago, Ill.

The Advance in Reinforced Concrete Construction (illustrated), by G. A. P. Turner, Minneapolis, Minn.

Cement Pipe as Used for Drainage and Irrigation, by F. A. B. Patterson, Fairmont, Minn.

The meetings at Chicago of the two organizations named will be followed on Jan. 21-24, 1908, by the fourth annual convention at Buffalo, N. Y., of the National Cement Users' Association. On Feb. 19-21, 1908, the Iowa Association of Cement Users will hold its fourth annual convention at Des Moines, Iowa. Mr. M. A. Williams, secretary of the Iowa association, will furnish information concerning the convention programme. The exhibit space for the Buffalo convention is in charge of Mr. Dai H. Lewis, 760 Main street, Buffalo, N. Y.

The production of petroleum in the United States during 1906 was 126,493,936 bbls.

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

The Method of Operating a Lobnitz Rock Cutter in Canal and Harbor Work.

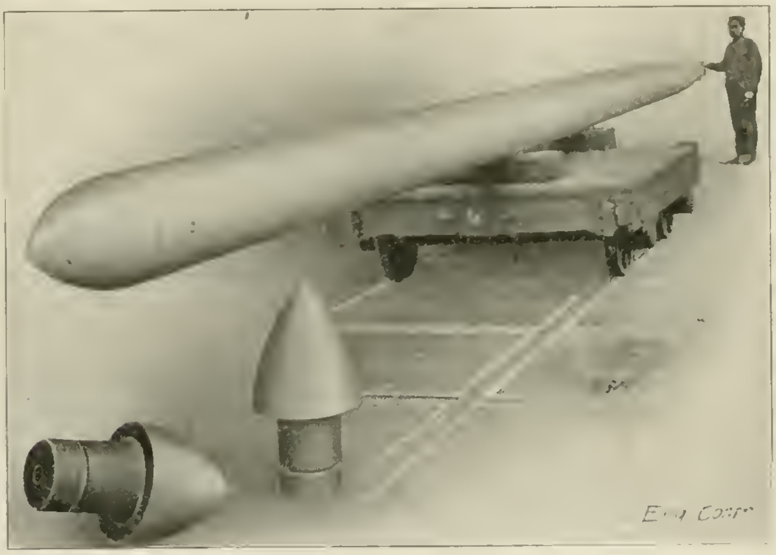
BY LINDON BATES, JR.*

At Black Rock Harbor, near Buffalo, and at Fort Edward, New York, a machine new to this country has recently been introduced to shatter submerged rock to a size capable of being handled by dipper dredges. This most modern competitor of the drill and dynamite boats is the Lobnitz Rock Cutter.

A huge projectile, 33 ft. in length, 2 ft. in diameter and weighing 46,000 lbs., is lifted 8 to 12 ft. by means of an exceptionally heavy winch, to fall with terrific momentum on to the rock 20 ft. under water, when a trigger released it at the top of its stroke. Ten to twenty times the great javelin crashes down into the hole shivering a cubic yard or more in volume into fragments. The barge on which the machine is erected is then warped from 3 to 5 ft., depending on the nature of the rock, and the process is repeated.

This process is the latest that engineering science has devised for what has been one of the greatest problems in excavation and harbor improvement work—the shattering of submerged rock into such sizes as can be lifted and carried away by dredges or grab-bucket machines.

If one goes to a harbor like that of Buffalo, or to various other ports where rock occurs in the bottom, he can see the old and crude method of accomplishing the work the rock cutter is now doing. Half a dozen drill boats are moored over the section to be shattered and their steam drills are kept busy night and day making the small holes in the underlying rock, into which are to be put the dynamite charges. When a sufficient area has been honeycombed, another boat, the dynamite scow, is brought up and with infinite care these holes, 20 to 40 ft. under water, are loaded and the batteries attached.



Projectile or Cutter Used with Lobnitz Rock Cutter.

Then, all shipping must beware until the charge has been set off. The dangers and difficulties of such a process are as obvious as they are real. Only a few months ago a drill boat was blown up in Buffalo harbor by an unexpected explosion, and accidents are far from uncommon. The method, too, is very slow and the results inadequate, for the action of explosives in breaking up stone is very capricious. In one location the rock may be blown into infinitesimal pieces, while great chunks may be left, too large to be handled by the dredge. These require another charge before they can be broken up. The whole process is so expensive that the prices for excavating rock under water have been often around $2.00 per cu. yd., as against 75c for handling the same material above water by means of rock drills and steam shovels.

With the rock cutting machine the dangers of the explosives are eliminated at the outset. In addition to this, the rock broken is invariably of such a size and nature that it can easily be handled by the dipper dredges. The great shaft drops by its own weight on to the surface of the rock, concentrating the whole force of its impact on the surface of a few square inches. If the rock is hard and brittle it shatters like a piece of glass struck by a heavy hammer. The cutter is allowed to fall on the same spot until it has penetrated to the depth desired. The effect of this machine is to shatter an area of from 2 to 8 ft. around the point, thus inaugurating a process entirely different from the small hole and dynamite system.

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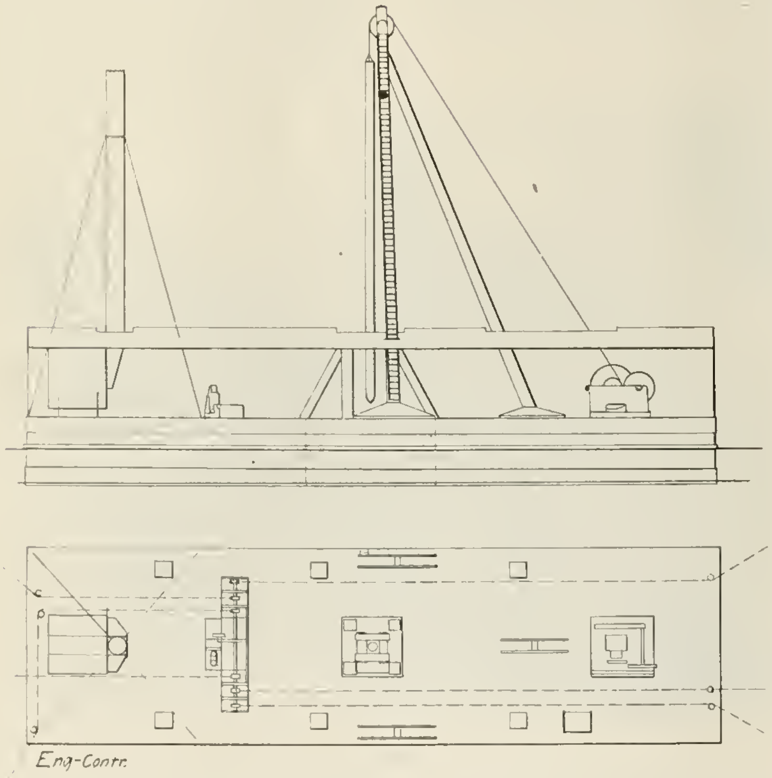
*71 Broadway, New York.

The rock cutter employed at Fort Edward is working upon Hudson River shale, a very brittle rock, breaking up readily. Each successive hole is spaced 3 ft. away. In this material the resultant pieces are rather larger than a man's head, increasing in size to about a foot and a half cube. The breakage comes off mostly in slabs roughly cubical in shape. Only that part which is directly underneath the cutter and which constitutes a small portion of the whole volume is crushed into small pieces. In Buffalo on very hard limestone interspersed with flint the rock broken up averaged about the size of cobble stones, varying either way. While the very much harder rock at this location requires more blows to the cubic yard than do the soft shales of the Hudson, nevertheless the sizes into which the material was shattered was about the same.



Sketch Showing Arrangement of Lobnitz Rock Cutter.

A further appreciable advantage of the cutter is that the rock which is broken up into these relatively uniform pieces can be used in order to keep the channel, where river work is being done, as at Fort Edward, between substantially parallel banks. Such rock training walls are in use on the Weser River in Germany and in many other locations abroad as a protection for the banks and to avoid the filling up of the channel from silt brought down by the stream. For wherever there is an expansion in a running stream the current becomes slower and silt is deposited, which compels constant dredging for maintenance. Where the banks are regulated by rock training walls the sand in suspension does not deposit and resilting is largely prevented, to great economy in the maintenance of navigation. In all river improvement where rock occurs the material, as broken up by the rock cutter, becomes especially convenient for making the training walls.

The construction of the apparatus is very simple. It may be compared to a magnified pile-driver. The cutting machinery is generally mounted upon a pair of barges joined together catamaran-fashion by logs of wood or steel girders. The balance and stability is maintained usually by a triangle of weights in which the boiler is in the stern of one barge, the big hoisting winch in the stern of the other and the sheer legs, making the tower upon which the projectile is to be hoisted, is placed in the middle. Where the projectile falls there is a circular hole, like a well, and the depth is taken at this hole to show when the point has penetrated far enough.

The hoisting winch, which may be considered the heart of the machine, is of very massive construction. About 3,000 blows are given in the course of a working day of 24 hours, for the machine is kept continually in operation. By a steel friction clutch and an automatic gear it is arranged that the wire cable for hoisting follows the fall of the cutter and raises the projectile again just as soon as the blow has been struck.

The tower, to the top of which the shaft or projectile is raised, is from 30 to 60 ft. high and is made of steel. A ladder leads to the top and there are chains installed by which the projectile can be held while any repairs are made on its point at the lower end.

The maneuvering winch consists of six drums from which cables radiate in each direction. If it is desired to move the rock cutter to port, the engineer at the maneuvering winch pulls in on the two port lines and lets out on those on the starboard side. In a similar way the rock cutter can pull itself forward on the bow line, aft on the stern line, and towards any corner by a combination of motions, very much as an octopus drags itself over the rocks by its tentacles. Under the original system chains were used for these maneuvering lines, but it has been found that wire cables are more satisfactory. In this feature the Americans may be said to have improved on the original Scotch machine.

While these machines make up the body of the rock cutter, the practicability of the whole tool focuses on the strength of a steel point about 30 ins. long, fitted into the bottom of the projectile shaft. Before the right composition of steel for points to deal with the different varieties of rock was even approximately understood, the original makers in Scotland had experimented for some ten years. The leading projectile makers of the United States have competed in trying to secure a point which would stand up against the very hard rock encountered at Buffalo. The final evolution of the detachable points may be summed up in the following sentence: "The inside core must be very hard; the outside tough but soft." In this way the point wears away on the sides where the iron is soft, exposing the point itself to the harder material. Thus, exactly as with a squirrel's tooth, no matter how much wear occurs, the point itself always keeps sharp. The maintenance of this sharpness is particularly important in order that the impact may be concentrated on a small surface, thus shattering more effectively.

The long trying out experience in Europe has demonstrated the curious anomaly that the hardest rock is not that which requires the hardest point. In soft abrasive material, such as sandstone, a particularly hard quality of steel may be profitably employed. But in the very finest rocks the point itself will very often shatter, because excessive hardness in steel carries with it brittleness. For this reason a soft and tough steel is in use in various places where the rock is exceedingly refractory. But in general it has been found that the hard core point meets the demands of both classes of rock. The experience of Lobnitz

& Co. in Europe and of the Empire Engineering Company at Fort Edward and Buffalo have developed various features, which make up the art of successful operation, in respect to points. The barge must be quite stationary so that the blows center all on the same spot, otherwise there is brought a leverage strain on the point and sometimes on the wellway. In the very hard rock at Buffalo the cutter let fall from the full height bounds away from 6 to 9 ins. on the first impact. A reduced drop for the first few blows is necessary to start the hole so that the shock might not be too great on the point, just as a carpenter hits the nail softly at first. During the working season of 1906 there arose a certain amount of trouble at Fort Edward, owing to the wear on the shoulder of the shaft. The shank of the point was forced above the holes made for the set pins. It was learned that the undue wear was due to the points not being tightly embedded in the shaft and shims were necessary to make it fit.

The normal life of a point in the very abrasive rock on the Manchester Canal in England has been about one month, night and day work. When worn to a 9-in. face they are replaced. The longest life was 17 weeks, the normal three or four weeks. At Tranmere, Liverpool, on rather harder rock than at Manchester they last five to six weeks. At Blyth, where the rock, mud and clay over rock-post sandstone, is harder but less abrasive, points have lasted two to three months with only 1 in. wear. At this place about 1,400 cu. yds. per week was the average output with 15-ton cutter, night and day work. At Fort Edward, New York, in Shale, points have lasted four months.

The rock cutter was patented by the firm of Lobnitz & Co., in Renfrew, Scotland, and its widest development has taken place abroad. At Bari, in Italy, Brest in France and the Iron Gates of the Danube, on rock very hard and tough, the rock cutter was applied with notable results. The most striking results, however, have been achieved upon the Manchester ship canal, where several machines are employed. The work is in sandstone of various degrees of hardness and a bank of rock 2 ft. in thickness had to be removed to increase ruling depth of the canal from 26 to 28 ft. The Chief Engineer of the Manchester Canal, W. Henry Hunter, has written extensively on the rock cutter's possibilities. A summary of his report as to its operations is as follows:

"Manchester Ship Canal; deepening from 26 ft. to 28 ft.; Lobnitz rock cutter No. 1.

"Average quantity (over a period of ten months) of rock broken up, per month, 6,403 cu. yds.

"Minimum quantity of rock broken, 5,622 cu. yds.

"Maximum quantity of rock broken per month, 10,160 cu. yds.

"The rate of advance of the rock cutter averages 36 ft. per diem, the bottom width of the canal being 120 ft.

"(Signed) W. Henry Hunter.

"Engineer's Office, June 19, 1903."

The introduction of the rock cutter into America may well mark a new step in harbor and river work.

[The Lobnitz Rock Breaker used in deepening the Suez Canal was equipped with two cutters 44 ft. 7½ ins. long, each weighing 13 tons. The machine was capable of delivering 132 effective blows per hour, but, owing to the delays in moving the breaker barge out of the way of vessels, only 83 blows were averaged per hour. The thickness of the rock excavated and broken up by the breaker was 2 ft. 7½ ins. It required 5.4 blows to break up a cubic yard. This meant a little more than 15 cu. yds. per hour, or 150 cu. yds. of rock broken up to be handled per 10-hour day. The rock in the Suez Canal consists of "limestone more or less hard, calcareous or silicious agglomerates, generally containing shells, calcareous tufa of a red color, gypsum and alabaster." In building the canal this rock was excavated out of water.

On the rock excavation under water at Blyth, England, a breaker weighing 15 tons was used. The rock was a sandstone variable in character from shale to hard and tough sandstone. It was found that a fall of 8 ft. gave a penetration of 3 ft. into the rock with the breaker, in from 8 to 9 blows. This depth allowed the dredge to excavate the rock to a depth of 2 ft. 6 ins. After considerable experimenting it was found that blows struck 4½ ft. apart were close enough to break up either the hard or soft rock. Working day and night, the average yardage broken up per week was 908. This is computed from records kept for 6 months. The quantity of rock broken is ascertained by the number and depths of the penetrations of the ram in a given time, which are recorded, and, after dredging, the amount of rock removed is checked by soundings.

At Blyth 150,000 cu. yds. of rock had been excavated by drilling and blasting before the Lobnitz breakers were installed. From the records kept, a comparison of the costs of the two methods has been possible. It has been found that the difference in cost per cu. yd. has been about ⅓ less when using the breaker than when drilling and blasting. Not only has a saving been effected in breaking up the rock, but the efficiency of the dredge has been increased by the rock being in better shape for the dredge to handle, thus reducing the actual cost of operating the dredge per cu. yd. of rock excavated.—Editor.]

Fires started through crime or mischief have cost the people of the United States $210,852,546 in 21 years, according to official fire insurance tables. To these causes the fire insurance experts attribute about 31,000 of 369,298 fires that have occurred in 21 years.

Ambiguous and Onerous Specifications for Rock Excavation.

The following clauses are copied from two sets of specifications covering railroad graduation:

"Solid rock will include all rock in place, which rings under the hammer, in masses of more than 1 cu. yd."

"By solid rock will be understood rock which rings under the hammer, found in masses containing more than 1 cu. yd."

These clauses are similar to others occuring in specifications covering rock excavation. They are both ambiguous and onerous. What does the writer of the specifications mean by "rings under the hammer"? Does he mean that the rock shall give out a metallic ring when hit with a hammer or does he mean that in drilling the drill steel will ring out clear when struck with a hammer? The last sound is a familiar one to all contractors, and they would no doubt believe the specification referred to that kind of a ring.

If this is the meaning of the clause, it is not an equitable provision. One of the editors of this journal remembers distinctly, when doing some work under a contract with specifications similar to the above, that in putting down some 12-ft. holes with hand drills, after the holes were 2 ft. deep, the drills gave out the familiar ring under the rapid strokes of the steel drivers, and as the work was in a narrow mountain gorge the metallic sound echoed and re-echoed. The work was in a borrow pit selected by the engineer in charge of the work, and according to the ring all concerned thought they had 11 ft. of solid rock. When the blast was made less than half the material was found to be solid rock. The sandstone rock was in thin layers with disintegrated shale between them, and the thin layers acted as a sounding board for the ring of the steel to vibrate, thus intensifying the sound. On the other hand, it is a well known fact that many solid ledges of rock do not ring clear when struck by the drill, but instead give out a dull, dead sound. Such a clause cannot be depended upon for classifying rock. If the specification means the ring of the drill under the hammer, it should state so.

That a different interpretation can be put upon these clauses is shown by the fact that one engineer classifying rock under such a clause carried with him a small geological hammer to use in striking the rock. The pay of the contractor was dependent upon the ring of the rock, when struck by this hammer. Nothing could be more onerous or unfair. Few rocks will give a metallic ring when struck with a hammer, especially when in place, yet they may be very costly to blast and break up. If this is the test to be made for classification it should be so stated.

What are the results from such a clause? It is evident that the engineer can put any classification upon the rock excavation that he may wish. This will cause disputes with contractors, but the latter, as a rule, will accept the engineer's classification, as they realize that their only redress is a suit at law, and these are expensive even when won.

It is time that such clauses were eliminated from specifications and contracts, and one of the duties for the American Society of Engineering Contractors to undertake will be a revision of existing contracts and specifications.

Surfacing and Dressing Earth Work.

In taking contracts for earth excavation one item of work to be done that should be given careful consideration is that of dressing up and surfacing the place of excavation and the place of depositing the earth. It is true that this work does not have to be done until at the end of the job, and for that reason there is a chance of underestimating the cost. Plans and specifications for this work should always be included in the regular specifications and should be put in the hands of contractors when they are bidding. This is seldom done.

Some years ago one of the editors of this paper, then doing some excavation work, suffered because this was not done. He undertook a piece of work, believing that the surfacing and dressing would be done in a manner that was usual on that class of excavation. Nothing was said in the specifications as to how the work was to be dressed, but at the end of the job the engineer in charge of the work gave the contractor extensive and minute plans as to how the work should be surfaced and dressed. These plans saved money to the company having the work done, but they added to the cost of dressing. The increased cost was not enough to make the work a money losing proposition, but it did take away several hundred dollars of profits.

On wagon road and race track work the dressing and surfacing is sometimes a large per cent of the total cost. On railroads and large embankments if the work is properly managed the cost of dressing should be a very small part of the cost. Contractors should impress this fact upon their foremen and put into the hands of their foreman, hand or Locke levels, instructing them as to their use, so that all cuts can be taken to grade, and embankments carried to their full height, including shrinkage, as the work is being done. A Locke level will be found of vast assistance in this.

It must be remembered that when the dressing up of work is done, that the quantities of excavation have already been paid for in the monthly estimates, and if the work is made over-expensive that the contractor feels the cost of the work keenly, as his current receipts from the job may not exceed his expenses. A contract should be managed to show a profit, each month, if it is possible to do so. When excavation is not done carefully and according to stakes, and in an orderly manner, the cost of surfacing and dressing is always high. The cost will always be greater when levels are to be run over the finished work, than when they are not, unless frequently levels have been used as the work has progressed.

When this class of earthwork is done by hand, the cost is far more than when done with machines. See "Gillette's Earthwork and Its Cost," page 34. Machines should be employed whenever possible, and there are a number of such machines in the market, yet contractors, in many cases, persist in doing this work by hand.

Engineers seldom omit from their specifications how the surface of concrete structures are to be dressed, yet they do not seem to give a thought to the surfacing of earthwork, until the time comes to do it. They should state, before the job is let, how the work is to be dressed and surfaced and they should remember that if they specify "sandpapering" that they will add materially to the cost of the work, especially where the yardage is small. For an example of this kind see ENGINEERING-CONTRACTING, Jan. 9, 1907, page 14. No matter what is wanted, it should be clearly stated in the specifications, and contractors should post themselves in the matter before making their bids.

The Cost of Digging Post and Pole Holes by Hand.

In building fences, holes are dug at frequent intervals for the posts. At one time these post holes were dug entirely with bars and shovels. To-day there are on the market a number of patent post hole diggers and augers designed to do this work quicker and more economically than by bars and shovels.

A post hole digger may be termed a tool that does its digging by being driven into the ground, and as it loosens the earth picks it up, to be taken out of the hole. An auger is not driven into the ground like a digger but is forced down into the ground by a man pressing on it, while at the same time he turns it like a carpenter does an auger, in boring a hole through wood. The auger bores a hole, rather than digs it. For this reason the hole made is the same diameter as the auger. The hole that a digger makes is generally a little larger than the width or diameter of the tool. This is due to the fact that the tool is lifted up and down as it is driven into the ground.

When digging a hole with a shovel and bar it is seldom less than 12-in. wide at the top, but it loses about one-third of its diameter as it is taken down, when the holes are not over 3 ft. deep. This is due to the fact that the shovel used for this purpose cannot be worked in a smaller hole. Time is lost in hard ground by having to change from the shovel to the bar, as it is necessary to use the latter to loosen the earth. On the other hand both operations are done by the digger and auger. A post hole auger is illustrated in ENGINEERING-CONTRACTNIG for Oct. 30, 1907, p. 250, and a digger in the issue of Dec. 11, 1907, page 333.

We are enabled to give a record of digging some post holes by hand with the bar and ordinary long handled shovel. The fence posts were 7½ ft. long, 2½ ft. being put into the ground. The diameter of the post was 6 ins. The soil was a red clay. The holes being 2½ ft. deep, were 12 ins. in diameter at the top, but averaged 10 ins. This made 1⅜ cu. ft. of excavation for each hole. The wages paid to the laborers were $1.50 for a ten-hour day. A man dug 40 of these holes per day, thus excavating about 2 cu. yds. of earth each day. This made a cost of 3¾ cts. per post hole dug, and a cost of 75 cts. per cu. yd. of excavation. With 440 post holes to a mile of fences, posts being on 12 ft. centers, this cost per post gives a cost per mile of $16.50.

A comparison of this with the cost of similar work done with an auger will no doubt be of interest. In ENGINEERING-CONTRACTING for Aug. 28, 1907, page 133, is given some costs of digging post holes with an auger. On that job 5 in. posts were used, and the holes were dug with a 6-in. auger, the holes being 2½ ft. deep. Only ½ cu. ft. of earth was thus excavated from the hole, as compared to 1⅜ cu. ft. One man in a 10-hour day with wages at $1.75, digging 84 holes, made a cost of 1.8 cts. per hole, or a cost per mile, 440 holes, of $7.92. Thus it is seen that with, a higher wage, the cost was more than 50 per cent less, which needs no comment in affixing the value of the patent digger and auger.

Another example of the cost of digging holes by hand was in making holes for some 12-in. steel channels that were to be used as the posts for a large storage bin for coal. The 12-in. channels were 24 ft. long and 4 ft. of them were to be buried in the ground, embedded in concrete. For this reason the holes were made 2 ft. in diameter and 4 ft. deep.

The tools used in digging the holes were, a digging bar, a shovel and a spoon. The holes were kept 2 ft. diameter to the bottom, the spoon allowing of this being done. From each hole 12½ cu. ft. was excavated. One man dug 3 holes of this kind a day. The ground was a stiff clay, and all of it had to be loosened with the bar. With wages at $1.50 per 10-hour day the cost per hole was 50 cts. In a day a man excavated 1.39 cu. yds. of earth, which made a cost per cu. yd. of $1.08. Some of the patented diggers are adapted to this work and would no doubt have reduced this cost somewhat.

In a future issue we expect to give some cost on digging pole holes for trolley and transmission lines.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

LETTERS TO THE EDITORS.

Cost Analysis in Engineering Colleges.

Sir: I have received a Dec. 4 copy of Engineering-Contracting, in which my attention is called to an editorial article on "Why Actual Cost Records Are of Little Value Unless Analyzed in Component Elements."

I am glad to have had my attention called to this article. Broadly speaking the "professors" have been, are now and always will be blamed much for the general sort of thing for which you apply blame in this article, simply because they cannot send the engineer student forth with training complete and satisfactory in all cases and in all respects. Thus professors, as other men, are in a calling that commands at all times greatest effort to improve the training as actually rendered in order that it may always meet more nearly with requirements.

I have observed again and again, where some important thing was omitted or not treated properly in the training of an engineering student, that he would supply the omission or improve the training only years after, and then only when forced to through urgent practical necessity. Whereas, had he been started off rightly, he would have built upon such stock and profited accordingly from the date he entered practice.

The professors, like other men, are a product of their environment and of the stress and pressures therein put upon them. An article like this one is a great help in supplying a professor with the justification he needs for giving the proper amount of attention to cost analysis, a justification that will withstand the pressure upon him that tends to keep out of the course much reference to anything of the sort.

Years ago I had a student who had talent for electrical machinery design. He left college with a good start in the technology of elementary electrical machine design and without a corresponding start in cost analysis and the relation of all costs to practical design. This young man soon became a successful assistant technical designer in the service of one of our large manufacturing companies. Ten years after graduation, however, he found that further promotion was impossible for him because he had no adequate knowledge of cost analysis. He had to get up the subject then as best he could under great difficulties, whereas if his attention had been properly directed to the subject while in college he would have realized its importance at the start; throughout his first ten years in practice he would ever have been on the alert to improve his knowledge of costs in relation to design, knowing that in the end his final success would depend upon his ability to handle costs as well as the technology of machinery.

Yours very truly,
Harris J. Ryan,
Professor of Electrical Engineering,
Leland Stanford Jr. University.
Dec. 9, 1907.

Advantages of Oxen Over Horses on Short Hauls.

Sirs: It may seem somewhat of a novelty to employ oxen in place of horses in these days of rush and turmoil. But in the city of Haverhill, Mass., oxen are employed in the construction of a state road, at a profit over horses, according to Contractor Adams of Andover, Mass.

At the outset oxen can be bought for 5½ cts. a pound on the hoof and can be turned into cash at the end of the working season at the same figure. On the work at Haverhill none of the oxen has shrunk in weight since construction began (some three months ago) and several pair have gained weight.

Horses, on the contrary, must either be sold at a loss when construction is shut down or else be carried through the winter months while teaming is slack and grain high. The wear and tear on wagons and the item of shoeing is about the same with either oxen or horses, while with oxen there are no harnesses to break.

The cost of maintenance per pair for one week is as follows:

	Oxen.	Horses.
Stall hire	$ .50	$ 2.00
Teamster	10.00	12.00
Hay at $20 ton	5.00	3.00
Meal at $1.60 bag	3.20	1.60
Bedding	.50	.50
Corn at $1.60 bag		1.60
Oats at $1.50 bushel		1.50
	$19.20	$22.20
Cost per pair per working day	$ 3.20	$ 3.70

In comparing work done it will be well to bear in mind that the horse carts are backed into the pit, the teamster shovels and the cart is at a standstill while being loaded.

The ox cart is backed in, the teamster does not shovel, but yokes his oxen on a loaded wagon or the nearest loaded wagon and there is thus practically no lost time for the oxen. Notwithstanding that the teamster shovels and the horses walk faster than the oxen, the oxen actually deliver more loads per day whenever the haul is 600 ft. or less from the pit.

By actual test of two sets of teams the same day, same haul, same foreman and just enough extra shovelers so that no team need wait when loaded, I obtained the following:

Test of two pair oxen—

8 men loading at $1.60	$12.80
2 men spreading at $1.75	3.50
One-half foreman's time at $2	1.00
80 loads at 4 cts. a load	3.20
Cost per day, two ox teams	6.40
	$26.90

Eighty loads at 50 cts., contract price, equal $40, leaving profit of $13.10 in favor of oxen, or $6.55 per pair for day.

Test of two pair horses—

6 men loading at $1.60	$ 9.60
2 men spreading at $1.75	3.50
One-half foreman's time at $2	1.00
64 loads at 4 cts. a load	2.56
Cost per day, two horse teams	7.40
	$24.06

Sixty-four loads at 50 cts., contract price, equals $32, leaving profit of $7.94 in favor of horses, or $3.97 per pair for day.

Under these conditions the oxen prove to be more profitable by $2.58 a day over horses.

No attempt is made to criticise methods, etc., in this article, but data obtained simply to compare the use of oxen with horses unknown to either laborers or teamsters. There is no doubt but what the horses might be speeded up a little more, while the oxen could not be, and an increase in the length of haul would place the oxen at a disadvantage and they would then be of more value as beef.

But the figures certainly prove the contractor's contention and the oxen have afforded an interesting item on the work, and, like Barnum's ploughing elephant, have given the contractor no little free advertising, as a dozen oxen at work within the city limits is certainly a rarity in this section.

Yours very truly,
D. H. Winslow,
Resident Engineer,
Massachusetts Highway Commission,
Dorchester, Mass.

Jefferson county, Texas, has voted a $300,000 bond issue for the construction of shell roads.

A resolution is now before Congress recommending the appropriation of $1,250,000 to defray the expense of a survey and the obtaining of a right of way for a ship canal between lakes Erie and Ontario, the channel to be large enough to accommodate the largest vessels now sailing the great lakes.

Methods and Costs; Some Old, Some New.

Laying Submerged Pipe Line.—An 8-in. water main about 2,800 ft. long was pulled across a river by means of four locomotives on the opposite shore, attached to the pipe by a wire cable. The pipe was joined in 500-ft. sections and launched through a trench lined with boards. Extra heavy wrought iron pipe was used. In order to prevent the pipe being buried too deep in the mud as it was pulled across, it was buoyed up at intervals of 500 ft. by lighters.

Sprinkling Car Tracks.—The cost of sprinkling the street car tracks of the Detroit United Railway of Detroit, Mich., amounts to $4,123.32 per season; the company has eight sprinkling cars in operation, the cost for each car per year thus being $511.67. Two of the cars have tanks of a capacity of 3,670 gallons each, and six cars have a tank capacity of 3,702 gallons each. A car having a tank capacity of 3,702 gallons sprinkles at one filling 3.3 miles of track to a width of 8 ft. The rate per hour is 10½ miles.

Cutting Off Trenches.—A canal constructed across some marshes was intersected by a number of narrow trenches which had been dug previously to reach a marl deposit. These trenches were 1½ ft. wide and some of them had a maximum depth of 34 ft. In order to cut off these trenches from the canal the following method was pursued: A pipe 12 ins. in diameter was lowered into a trench and forced down by a small ram. This pipe was then filled half with sand and half with water, the latter being added so that the sand would run freely. The pipe was then raised and in this way a sand cone extending to the surface was formed in the trench. A row of piles, 6 to 10 ft. wide, was then driven across the trench and through the sand cone, the ends of the piles entering 3 ft. or more into the firm ground beneath. Twenty-three trenches were cut off in this way at a cost of $60 to $140 each.

Data on Iron Ore Roads.—In the Missabe and Vermillion ranges in Minnesota there are about 100 miles of road surfaced with lean iron ore. These roads are generally constructed of ore of about 25 per cent value with clay and gravel, the system of construction being about the same as for gravel roads. The sub grade is generally made 20 to 30 ft. wide, graded, drained and rounded, and the surfacing material is placed for a width from 12 to 20 ft., 6 to 9 ins. deep, spread uniformly but not rolled. Such roads soon become hard and smooth if well taken care of and generally are very satisfactory. The cost of maintenance is about the same as for gravel roads, but so far no well defined system of maintenance had been put in operation except near the mines or range cities where traffic is heavy. The objections to the roads are dust in dry weather and discoloring, paint-like mud when wet. These features make the use of this material objectionable for city or village streets. The average cost of these roads is as follows: Material furnished free at mine dumps; cost of loading, about 10 cts. per cubic yard; haul, 25 to 35 cts. per cubic yard, per mile; distributing, 3 to 5 cts. per cubic yard; average amount put on the roads, 100 cu. yds. per mile for each foot in width. The general average cost of roads on 2-mile haul for 16-ft. road equals $1,120 per mile. Some roads have been built on a 4-mile haul for $1,350 per mile, 14 ft. wide. Mr. George W. Cooley, state engineer of Minnesota, to whom we are indebted for the informtaion in this note, has made the following additional estimates of cost of these roads: One to 4-mile haul, $1 per cubic yard; less than 1 mile, 60 cts. per cubic yard; over 4 miles, $1.25 per cubic yard. He has advised using a top dressing of 2 ins. screened gravel, which he thinks will tend to counteract the objections of dust and mud. Mr. Cooley states that the lean ore road is a good road, reasonably cheap in construction and maintenance, satisfactory as to hardness and water shedding, and very serviceable.

Gravel Road Data.—Mr. Chas. C. Huffine, county engineer of Clinton county, Ind., has given us the following data on the construction of gravel roads in that county:

	Per cu. yd.
Cost of gravel at pit	$ .10
Stripping pit	.05
Hauling	.30
Dumping and spreading	.03
Shoveling	.10
Miscellaneous	.05
Total	$ .63

As about 1,800 cu. yds. of gravel are required per mile of road, the cost will be $1,134. In addition Mr. Huffine estimates the cost of grading the roadbed at $200 and the cost of bridges and culverts at $200, making the total cost per mile $1,534. The above estimate is for bank gravel. The majority of roads built in Clinton county, however, have been made from gravel taken from wet pits, making an additional expense of 25 cts. per cubic yard for dipping or 10 cts. per cubic yard for pumping water, depending on the method by which the gravel is taken out. This would increase the cost of the road $450 or $180 per mile respectively. The above are about the average cost of gravel roads in Clinton county for the past five years. The contract prices for these roads has varied from $1,750 to $2,100 per mile. The specifications for the construction of a gravel road in the above county require the roadbed to be graded to a width of 24 ft. and the gravel surfacing to be placed to a width of 9 ft. The gravel is required to be placed 15 ins. deep at the middle and 9 ins. at the side. Common labor in Indiana is paid about 13½ cts. per hour, and about 30 cts. per hour is paid for a two horse team and driver.

Sinking a River Shaft.—The river shaft of the new water works tunnel of the city of Detroit, Mich., has an inside diameter of 10 ft. and is placed at the center of the intake crib. The shaft was built in a steel cylinder having a diameter of 14 ft. at the bottom, with a cutting edge extending 3 ft. below the curb which held the brickwork. This cylinder was sunk to the bottom of the river through an opening in the crib, and was then sunk through about 26 ft. of earth to the top of the tunnel. Guide timbers were first placed at the crib to keep the cylinder in a vertical position; it was then placed on a raft inside the crib and a watertight floor put in under the curb. The raft was so constructed that it could be removed when the shaft had nearly reached the bottom of the crib by releasing the lines on one end and pulling the timbers out at the other. As a precaution the lines holding the raft were attached to the heavy cross timbers of the crib at the top so as to support the shaft if it leaked enough to overcome its buoyancy. A pulsometer was also placed inside and hung from the derrick. The steel shaft was made in sections and riveted together in the crib as the cylinder was sunk. The brickwork was started on the curb and was successfully built up for a height of about 16 ft., when the shaft was found to be so close to the bottom that the raft had to be removed in order to permit the shaft to enter the opening left for it in the bottom of the crib. When the work had reached this stage, through an accident to the pulsometer and the negligence of the night watchmen, the shaft filled with water and sank to a depth of about 4 ft. into the bottom of the river. The shaft was in its proper location, however, and the accident was remedied by blanketing the ports through which the water entered the crib and pumping out the water from the inner chamber of the latter so that another section could be riveted to the shaft and the water pumped out of it. The watertight floor was then removed and the brickwork continued to the top of the lower cylinder. As the brickwork was built up, the shaft kept sinking into the clay, which was carefully excavated so as to keep the shaft plumb, and there was so little resistance by friction that without any external loading the shaft sank to the top of the tunnel landing almost exactly in its proper location. The constructions of the river tunnel, and the shaft noted above, were described in a paper by James Ritchie, read before the Civil Engineers' Club of Cleveland and printed in the November, 1907, Journal of the Association of Engineering Societies.

Data on the Cost of Road Treatment by the Metropolitan Park Commission of Massachusetts During 1907.*

BY JOHN R. RABLIN.†

At the meeting of the association about one year ago I described the experiments we had just made in the treatment with "Tarvia" of about 3½ miles of park roadway in Revere, Chelsea and Everett. At that time little could be said as to its durability or wearing qualities, as the work had been completed only a short time. As it has now had a test of one year with rather unusual winter conditions attending, we are able to judge somewhat of its merits.

During the winter one portion of the roadway for a distance of about 2,000 ft. showed signs of scaling, the top surfacing of tar and screenings about ¼-in. in thickness, breaking up and leaving the roadway in about the condition it was in before treatment. In my opinion this action was due primarily to the condition of the road on which the "Tarvia" was placed, an excessive amount of binding material having been used in its construction, and this prevented the proper penetration of the "Tarvia." Nevertheless, after the scaling, the road remained in good condition and seemed to have received some benefit from the treatment. One other section of the roadway, about 1,500 ft. in length, appeared to have been too lightly treated, that is, too little material was used or it penetrated more rapidly or to a greater extent than ordinarily, as the larger stones of the road were not covered with the surfacing of "Tarvia" and screenings. The road, however, seemed to be thoroughly bonded and remained in good condition. With the exception of these instances the treated roadway remained in excellent condition throughout the winter and spring, and it was evident that, generally, winter conditions and frost had no bad effects. The roadways have been clean and free from dust or mud. In July of this year some other portions of the roadways began to show the effects of wear, and during July and August about one-half of the 3½ miles treated last fall, including the portion which scaled and the portion which was improperly treated, were re-treated with "Tarvia" and the balance of the 3½ miles were patched where necessary.

The cost of the re-treatment was at an average of 6.4 cts. per square yard. Considering the 3½ miles as a whole, the cost of maintenance of the "Tarvia" surfacing, including re-treating and patching, has been 3½ cts. per square yard.

During this year about 90,000 sq. yds. of roadways have been treated with "Tarvia" at an average cost of 7.3 cts. per square yard, in addition to the maintenance of that laid in 1906. The location, amount and average cost per square yard of the new work is shown in the accompanying tabulation:

DATA ON THE COST OF TARVIA TREATMENT OF ROADWAYS BY THE METROPOLITAN PARK COMMISSION OF MASSACHUSETTS, 1907.

Roadway.	Work done 1907.	Total cost.	Sq. yds. treated.	Tarvia used, gallons.	Stone used, tons.	Cost per square yard. Labor.	Tarvia.	Stone.	Total cost per sq. yd.	Tarvia-gal. per sq. yd.	Stone—ton. per sq. yd.
Mid. Fells, Pleasant st. to N. side Highland ave	Aug. 19-31	$1403.74	15,000	8,846	234	.0318	0383	0234	0935	5897	0156
Revere Beach Parkway, Main st. to Fellsway	June 20 to July 6	912.33	12,780	4,087	219 6	0200	.0250	0260	0710	.3200	0170
Revere Beach Parkway, Brdwy., Everett to Eliot Circle	July 6 to Aug. 17	3020.53	47,260	18,182	712	0151	0282	0206	0639	3840	0150
Winthrop Shore	Sept. 23 to Oct. 12	1635.95	23,500	10,845	256	0215	.0324	0157	0696	4615	0109
Lynnway and Northern Circle	Sept. 16 to Sept. 21	736.55	8,840	4,710	189.5	.0185	0376	0272	.0833	.5300	0214
Revere Beach Res., Revere st. to Cove st.	May 22 to June 22	1315.37	22,825	8,955	359	.0107	0282	0188	.0577	4011	.0167
			Average cost			0196	0316	.0219	.0731	.4477	0161

The variation of the cost per square yard is due principally to the condition of the roadways treated, the cost of labor* for cleaning, etc., varying the greatest amount, and the cost of "Tarvia" varying somewhat with the amount required for the different conditions of roadway.

Some portions of this new work which has been done this year have developed one rather unsatisfactory condition which is that the "Tarvia," after it has been on the road a short time, has drawn up into bunches, making the surface of the roadway uneven and rough. It was at first thought that this condition was due to improper spreading, but upon investigation and observation of work done after the first occurrence of this, which work was done with particular care, it was evident that it was not caused by faulty work but probably by a variation in the "Tarvia" furnished us. This condition did not seem to materially lessen the effectiveness of the treatment, but it has not the smooth and even surface of most of this work which we have done.

It is my opinion that, generally, the results of the treatment of our roadways with "Tarvia" have been satisfactory, and it has been very effective in the preservation of the surface of the roads and in making them practically dustless and mudless.

Various experiments have been made by us during this year in the use of oil on the roads. The road from North Beacon st. to Riverside st., in the Charles River Reservation, Watertown, and a portion of the shore drive along Revere Beach Reservation have been treated with a petroleum product known as "Asphaltoilene," which is furnished and applied by the Good Roads Improvement Co. of Cincinnati, O. This material, I am informed, is a Kentucky oil with the naphtha and other volatile substances removed, leaving a heavy asphalt base, which is applied to the surface of the road in its natural state, without heating, by means of the "White Oiler," a machine used in the application of oil in California. This treatment required a road in particularly good condition, either nearly new or newly resurfaced, and very little cleaning is necessary, only the removal of loose dust.

The cost of this work was 6 cts. per square yard for the material and its application. The cost of cleaning, which was done by our own forces, was so slight that no account of the cost was kept.

The Charles River road is about one mile in length and is constructed with gravel surface. In the treatment of this road an excessive amount of oil was used on account of the uneven condition of the road at the time, and this made necessary the closing of the road for about a week to allow the oil to penetrate. It was also necessary to spread a light sprinkling of gravel over some portions to absorb the surplus oil.

This road has been in excellent condition since its treatment, which was in June, and has required no watering and no repairs. Although the appearance of the road was not very agreeable at first, we shall probably get the benefit of the excessive amount of oil used, as it now seems evident that the treatment will last another year if the frost does not injure it to any great extent.

About 17,000 sq. yds. or ¾ of a mile of the Revere Beach drive was treated with this material. This road is a macadam, had been constructed about one year, and was in very good condition. In the treatment of this road too little oil was used,

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*Paper read Nov. 12 before the Massachusetts Highway Association.

†Engineer Metropolitan Park Commission, Boston, Mass.

*The organization and wages per day of the force employed in the road treatment work were as follows:

1 Foreman	@ $2.75
1 Double team	@ 5.00
1 Single team	@ 3.50
7 Laborers, cleaning	@ 2.00
5 Laborers, spreading tar	@ 2.00
3 Laborers, spreading screenings	@ 2.00
1 Steam roller.	

especially on the sides of the road, on account of the fear of marring the concrete gutters and edgestones. Therefore, the road was not thoroughly bonded, and early this fall began to pick up a little. Another light treatment was given it where necessary, and it is now in very good condition.

I consider this treatment effective in preventing dust and in bonding the surface of the road, and especially for a gravel surfaced road. There is no offensive odor from this oil.

In the Middlesex Fells Division about 240,000 sq. yds. of roadway have been treated with a mixture of water gas tar and Kentucky oil similar to that just described. At the beginning of this work an emulsion with about 25% to 30% oil was used, but Supt. Charles P. Price, who was doing the work, experimented with the mixture of oil and water gas tar, and considered it somewhat cheaper and fully as good, and used it for the greater part of the work. This mixture is made in varying proportions of from 2 barrels oil and 6 barrels water gas tar, to 4 oil and 6 water gas tar, the amount of oil used depending somewhat on the condition of the road on which it was used. This mixture was heated by steam coil and applied by means of a special attachment to a watering cart, which was designed by Mr. Price.

This treatment thoroughly lays the dust at the time of its application and remains effective for this purpose for from 8 to 10 weeks, but after that time requires further treatment. This method has very little, if any, bonding qualities and does not prevent the roads from being stripped of their surfacing, the materials working into the gutters. Possibly after a number of applications of this material enough oil might accumulate to form a bond. As yet I have not obtained the details of the cost of this work, but the average cost of one application is about 4 cts. per square yard. The materials are purchased in barrels, and the work is performed by our own men. This is the extent of our work for the past season in this line, and I think great benefits have been derived from each method of treatment.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write direct to the advertisers and state that you saw the catalog mentioned in *Engineering-Contracting*. If you are in the market for tools, machinery or supplies tell us and we will notify promptly the leading manufacturers.

No. 0487. **Portland Cement.**—Alpha Portland Cement Co., Easton, Pa.

This 24-page pamphlet describes briefly the manufacture and general character of Alpha Portland cement, gives results of strength and fire tests, general instructions for selecting sand proportioning and mixing concrete and testimonial letters.

No. 0488. **Conveyor Belts.**—The McIlroy Belting & Hose Co., Chicago, Ill.

This circular describes briefly "Rubberite" belts for conveyors. Special claims are made for the durability of this belting and of the facts that it will run through water, oil or alkalies and that heat or cold will not affect it.

No. 0489. **Ferroinclave.**—The Brown Hoisting Machinery Co., Cleveland, O.

Ferroinclave is the name of a new corrugated sheet steel of special shape for reinforcing concrete slabs for roofing, floors, siding, etc. This 32-page pamphlet describes the construction of ferroinclave and the methods employed in constructing reinforced concrete slabs with it. The pamphlet is an excellent one and should be secured by all interested.

No. 0490. **Concrete Mixers.**—Eureka Machine Co., Lansing, Mich.

The Eureka mixer is a continuous mixer with automatic device for regulating and feeding the stone, sand and cement at uniform rates and in exact proportions. This 14-page pamphlet describes and illustrates the construction and operation of the mixer in detail.

No. 0491. **Reinforcing Metal.**—American Wire Fence Co., 189 La Salle St., Chicago, Ill.

The reinforcing described in this 48-page pamphlet consists of plain round rods underneath woven wire fabric, both of high carbon steel. The dimensions and quality of metal used are described, drawings and descriptions are given of special spiral reinforcing for columns, and tables of strength and other useful information are presented. The pamphlet contains a large number of halftone views of structures in which American reinforcing has been used.

No. 0492. **Reinforced Concrete.**—The General Fireproofing Co., Youngstown, O.

This is an unusually interesting pamphlet. Opening with an introduction on the general merits of reinforced concrete and a description of recent developments, the construction, analysis and method of placing the company's pin-connected girder frame reinforcement for girders is described. An interesting feature of the company's work is its practice, where this reinforcement is used, of designing, centering and furnishing a mill schedule of the exact lengths and sizes of lumber required. The company's cold twisted lug bar is described and results of strength tests and microscopical studies are given. The pamphlet contains 32 pages.

No. 0493. **Tubs and Buckets.**—The Brown Hoisting Machinery Co., Cleveland, O.

This 20-page pamphlet is devoted entirely to illustrations, descriptions and tables of capacities and dimensions of the large line of tubs and buckets made by the company named. The list includes buckets, shovels and grab buckets as well as dumping buckets. The catalog is a good one.

No. 0494. **"Novoid" Waterproofing Compound.**—The Abby-Dodge-Brooks Concrete Co., Newark, N. J.

This 11-page pamphlet gives full directions for waterproofing concrete by means of the compound named. This compound is a powder which is mixed with the cement and which, it is stated, does not affect either its color or strength, but will render the concrete waterproof and free from efflorescence.

No. 0495. **"Symentrex."**—A. C. Horn Co., 10 Burling Slip, New York, N. Y.

"Symentrix," which is briefly described in this 8-page circular is a paint made of Portland cement and flint which can be applied to cement or concrete surfaces to secure both waterproofing and tint.

No. 0496. **Concrete Dams.**—Ambursen Hydraulic Construction Co., Boston, Mass.

This 32-page pamphlet is well worth securing by every engineer interested in hydraulic power work or water supply. A number of dams built by the company named are illustrated and well described. Together with the companion pamphlet on Dam Design it gives a better treatise on reinforced concrete dam design and construction than is had in most text books on concrete.

No. 0497. **Air Compressors.**—McKiernan Drill Co., 170 Broadway, New York.

This 72-page catalog describes air compressors, their installation and work, and gives tables showing power developed by compressors. Various styles and sizes of compressors are illustrated in the halftones.

No. 0498. **Wind Mills.**—A. J. Corcoran, Corbin Building, New York, N. Y.

This 6-page circular illustrates wind mills built by the firm named. Special claims are made of great strength and for the fact that all parts are made to gage and are absolutely interchangeable.

Personals.

Union Bridge & Construction Co., of Kansas City, Mo., is to open an office in Beaumont, Tex.

Mr. W. F. Grant, City Engineer of Sault Ste. Marie, Mich., and Miss L. H. Miller, were married in that city last week.

Mr. William Goldamith has resigned his position as Assistant Engineer to the Board of Water Supply of New York City.

All offices of the Stone & Webster organization in Boston, Mass., are now located in the company's building at 147 Milk St.

Mr. Arthur O'Brien of the Fort Orange Construction Co., Troy, N. Y., has been appointed City Engineer of Utica, N. Y.

Mr. W. J. McDaniel has been appointed Chief Engineer of the Ballinger & Abilene R. R. Co., which proposes to construct a railroad between Ballinger and Abilene, Tex.

Hains Concrete Mixer Co., Washington, D. C., has moved its offices from the Kellogg Building to 723 Union Trust Company Building, that city.

Illinois Society of Engineers and Surveyors will hold its annual meeting Jan. 15, 16 and 17 at the University of Illinois, Champaign, Ill.

William S. Love, manager of the Wheeler Condenser & Engineering Co. of New York, died Dec. 11, at his home in Orange, N. J., of pneumonia, resulting from grip. He was 40 years old.

Mr. Wayne A. Clark, heretofore Assistant Engineer of the Duluth & Iron Range R. R., has been appointed Chief Engineer, with headquarters at Duluth, Minn., to succeed R. Angst, deceased.

Mr. R. R. Seymour has been appointed Chief Engineer of the Chicago, Indiana & Southern Ry., succeeding Mr. B. C. Rich, whose resignation of that position is mentioned elsewhere in this column.

Mr. R. O. Jones, for the past nine years connected with the Jeansville Iron Works of Hazelton, Pa., and for several years Chief Engineer of that company, has accepted a position as Chief Engineer of the Dayton Hydraulic Machinery Co., of Dayton, O.

The Monticello Construction Co., which is to build part of the Cumberland River & Nashville R. R. out of Tateville, Ky., has elected the following officers: President, J. H. Shearer; Vice President, J. H. Martin; Secretary, W. L. Baker; Treasurer, Charles McConnaghy.

Mr. Howard Egleston, Assistant Engineer, has been transferred from the Del Rio and Nogales branch of the Cananea, Yaqui River & Pacific R. R. (the Southern Pacific's Mexican concession) to the company's work at Mazatlan, where he will have charge of track laying and bridge work.

Mr. S. P. Hull, Engineer of Signals of the New York Central & Hudson River R. R., has been appointed Engineer of Maintenance of Signals, with office at New York. Mr. W. H. Elliott succeeds Mr. Hull as Engineer of Signals. They will have jurisdiction over all divisions except the electric division.

Mr. L. D. Hadwen, Assistant Engineer of Bridges and Buildings, Chicago, Milwaukee & St. Paul Ry., has been appointed Acting Engineer of Masonry Construction, with headquarters at Chicago, Ill., to succeed Mr. J. J. Harding, who has been assigned to other duties in connection with the Pacific Coast extension.

Mr. B. C. Rich has resigned his position as Chief Engineer of the Chicago, Indiana & Southern Ry. and has formed a partnership with Mr. A. T. Carlson and Mr. Robert Fife, under the firm name of Rich, Carlson & Fife. The firm will have its offices in the Fort Dearborn Bldg., Chicago, Ill., and will engage in a general contracting business.

George Marlowe, a well known inventor, died recently at Seattle, Wash., aged 96. Mr. Marlowe was the inventor of a locomotive headlight, and he was said to be the first inventor to put a smoke consumer in the market. Mr. Marlowe was born in Dublin, Ireland, and was graduated from the university of that city. At the age of 33 he came to America.

William H. Ward, a well known contractor, of Lowell, Mass., was killed Nov. 28, at Groton, Mass., by the fall of a derrick, while he was directing the construction of a bridge over the Nashua River. Mr. Ward had been in the contracting business for about 40 years and during that time he built a large number of bridges in New England and New York State, including those spanning the Charles River at Newton, Mass., and the pier of the Harvard bridge between Boston and Cambridge, Mass. He also erected the monument on the Bennington battlefield at Bennington, Vt. He was 78 years old.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED

Bridges.

Dec. 18.	Cleveland, O.	Nov. 27
Dec. 18.	Granville, Ind.	Dec. 4
Dec. 19.	Doniphan, Mo.	Dec. 11
Dec. 20.	Red Wing, Minn	Dec. 11
Dec. 20.	Norfolk, Va.	Dec. 18
Dec. 20.	Pitcairn, Pa.	Dec. 18
Dec. 20.	Bartlesville, Okla.	Dec. 18
Dec. 24.	Greenfield, Ind.	Dec. 18
Dec. 27.	Baltimore, Md.	Dec. 11
Dec. 30.	Savannah, Ga.	Dec. 11
Dec. 31.	Victoria, B. C.	Dec. 18
Jan. 2.	New Orleans, La.	Dec. 4
Jan. 2.	Grants Pass, Ore.	Dec. 18
Jan. 2.	Forrest City, Ark.	Dec. 18
Jan. 3.	West Union, O.	Dec. 18
Jan. 6.	Fort Monroe, Va.	Dec. 11
Jan. 6.	Colfax, La.	Dec. 11
Jan. 6.	Hammond, Ind.	Dec. 18
Jan. 7.	Castle Haynes, N. C.	Nov. 20
Jan. 7.	Salem, S. Dak.	Nov. 27
Jan. 8.	Waseca, Minn.	Dec. 18
Jan. 10.	Wayne, Neb.	Dec. 18
Feb. 13.	St. Charles, Mo.	Oct. 30

Buildings.

Dec. 18.	Chicago, Ill.	Dec. 11
Dec. 19.	Ocala, Fla.	Nov. 13
Dec. 19.	Dayton, O.	Nov. 27
Dec. 19.	Milwaukee, Wis.	Dec. 11
Dec. 19.	Chicago, Ill.	Dec. 11
Dec. 19.	Minneapolis, Minn.	Dec. 18
Dec. 20.	New York, N. Y.	Dec. 18
Dec. 21.	Fort Worth, Tex.	Nov. 27
Dec. 21.	Madison, Kan.	Dec. 4
Dec. 21.	Washington, D. C.,	
Dec. 21.	Atlanta, Ga.	Dec. 11
Dec. 23.	Ann Arbor, Mich.	Nov. 6
Dec. 23.	Fort Des Moines, Ia.	Nov. 27
Dec. 23.	Soldiers Home, Cal.	Dec. 4
Dec. 23.	Jersey City, N. J.	Dec. 11
Dec. 23.	Reading, Pa.	Dec. 18
Dec. 26.	Richmond, Va.	Dec. 4
Dec. 26.	New York, N. Y.	Dec. 18
Dec. 27.	Tulalip, Wash.	Nov. 27
Dec. 27.	Tulalip, Wash.	Nov. 27
Dec. 27.	San Francisco, Cal.	Dec. 4
Dec. 27.	Allentown, Pa.	Dec. 11
Dec. 27.	Chicago, Ill.	Dec. 18
Dec. 28.	Milwaukee, Wis.	Dec. 18
Dec. 28.	Chicago, Ill.	Dec. 18
Dec. 29.	Viola, Kan.	Dec. 18
Dec. 30.	Lancaster, Pa.	Nov. 13
Dec. 30.	Monterey, Cal.	Dec. 11
Dec. 30.	Edwardsville, Pa.	Dec. 18
Dec. 31.	Philmont, N. Y.	Dec. 18
Jan. 2.	Flint, Mich.	Nov. 13
Jan. 2.	South Bend, Ind.	Nov. 20
Jan. 2.	Milwaukee, Wis.	Dec. 18
Jan. 3.	Albuquerque, N. Mex.	Nov. 20
Jan. 6.	Wichita, Kan.	Nov. 27
Jan. 6.	Cincinnati, O.	Dec. 4
Jan. 8.	Fort Spokane, Wash.	Nov. 27
Jan. 9.	Trenton, N. J.	Dec. 18
Jan. 10.	Cheyenne Agency, S. Dak.	Nov. 27
Jan. 10.	Punta Gorda, Fla.	Dec. 18
Jan. 11.	Fort Smith, Ark.	Dec. 18
Jan. 13.	Fort Monroe, Va.	Dec. 18
Jan. 13.	Fort Wood, N. Y. H.	Dec. 18
Jan. 13.	Santa Fe, N. Mex.	Dec. 18
Jan. 14.	York, Neb.	Dec. 11
Jan. 15.	Winnibago, Neb.	Dec. 4
Jan. 15.	Martinsburg, W. Va.	Dec. 11
Jan. 15.	Houston, Tex.	Dec. 11
Jan. 17.	East Liverpool, O.	Dec. 11
Jan. 18.	Pine Ridge, S. Dak.	Dec. 4
Jan. 20.	Richmond, Va.	Dec. 11
Jan. 22.	Poplar, Mont.	Dec. 11

Roads and Streets.

Dec. 20.	Washington, Pa.	Nov. 27
Dec. 20.	Milwaukee, Wis.	Dec. 18
Dec. 21.	Apollo, Pa.	Dec. 11
Dec. 23.	Denver, Colo.	Dec. 11
Dec. 23.	Dorranceton, Pa.	Dec. 18
Dec. 23.	Kansas City, Mo.	Dec. 18
Dec. 23.	Chicago, Ill.	Dec. 18
Dec. 26.	Harrisburg, Pa.	Dec. 11
Dec. 27.	Amity, Pa.	Dec. 11
Dec. 27.	New Brunswick, N. J.	Dec. 18
Dec. 27.	Baltimore, Md.	Dec. 18
Dec. 31.	Wyalusing, Pa.	Dec. 11
Jan. 2.	Ridgefield, Conn.	Dec. 11
Jan. 2.	Little Rock, Ark.	Dec. 11
Jan. 2.	Tipton, Ind.	Dec. 18
Jan. 3.	Salt Lake City, Utah	Dec. 4
Jan. 4.	Lisbon, O.	Dec. 18
Jan. 4.	Cleveland, O.	Dec. 18
Jan. 6.	Logansport, Ind.	Dec. 6
Jan. 6.	Lebanon, Ind.	Dec. 18
Jan. 6.	Danville, Ind.	Dec. 18
Jan. 6.	Crown Point, Ind.	Dec. 18
Jan. 7.	Vincennes, Ind.	Dec. 18
Jan. 11.	Noblesville, Ind.	Dec. 18
Jan. 17.	Washington, Pa.	Dec. 18
Jan. 18.	Fort Washington, Md.	Dec. 18
Feb. 4.	Billings, Mont.	Nov. 27

Sewers.

Dec. 18.	Springfield, O.	Dec. 4
Dec. 18.	Brooklyn, N. Y.	Dec. 11
Dec. 18.	Kankakee, Ill.	Dec. 18
Dec. 18.	Decatur, Ill.	Dec. 18
Dec. 19.	St. Paul, Minn.	Dec. 11
Dec. 23.	Milwaukee, Wis.	Dec. 18
Dec. 23.	Toledo, O.	Dec. 18
Dec. 27.	Youngstown, O.	Dec. 18
Dec. 28.	Evansville, Ind.	Dec. 4
Jan. 3.	Salt Lake City, Utah	Dec. 11
Jan. 6.	Hanley Falls, Minn.	Dec. 11
Jan. 6.	Durango, Colo.	Dec. 18

Water Supply.

Dec. 18.	New York, N. Y.	Dec. 11
Dec. 19.	Fort Dade, Fla.	Nov. 27
Dec. 27.	Sauk Rapids, Minn.	Dec. 11
Dec. 27.	Fort Leavenworth, Kan.	Dec. 18
Jan. 1.	Norway, Me.	Nov. 27
Jan. 1.	Orange, N. J.	Dec. 18
Jan. 8.	Tucson, Ariz.	Nov. 27
Jan. 10.	Phoenix, Ariz.	Dec. 11

Miscellaneous.

Dec. 18.	Madison, Wis.,	Concrete Work, Wrecking,	Nov. 13
Dec. 18.	New York, N. Y.,	Snow and Ice Removal,	Dec. 11
Dec. 18.	Baltimore, Md.,	Boiler Repairs,	Dec. 11
Dec. 20.	Portland, Ore.,	Steamboat.	Nov. 20
Dec. 20.	Lafayette, Ind.,	Electric Lighting,	Nov. 27
Dec. 20.	Chicago, Ill.,	Interior Finish,	Dec. 11
Dec. 20.	Fort Monroe, Va.,	Vessel Repairs,	Dec. 18
Dec. 21.	Chinook, Mont.,	Electric Light Works,	Nov. 20
Dec. 21.	Washington, D. C.,	Metal Work,	Dec. 4
Dec. 21.	St. Omer, Que.,	Wharf,	Dec. 18
Dec. 21.	L'Anse a La Barbe, Que.,	Wharf,	Dec. 18
Dec. 21.	Fort Benjamin Harrison, Ind.,	Fence,	Dec. 18
Dec. 21.	Chicago, Ill.,	Gasoline Lights,	Dec. 18
Dec. 23.	Portland, Ore.,	Hydraulic Dredge,	Nov. 27
Dec. 23.	Syracuse, N. Y.,	Garbage Disposal,	Dec. 18
Dec. 27.	Boston, Mass.,	Wreck Removal,	Dec. 4
Dec. 27.	Paducah, Ky.,	Tenders,	Dec. 4
Dec. 30.	Dayton, O.,	Conduit System,	Dec. 11
Dec. 30.	Richmond, Va.,	Gas Mains,	Dec. 18
Dec. 31.	Altoona, Pa.,	Garbage Disposal,	Dec. 11
Jan. 1.	Charleston, W. Va.,	Street Lighting,	Dec. 18
Jan. 6.	Boston, Mass.,	Masonry, Etc.	Dec. 11
Jan. 7.	Reading, Pa.,	Garbage Disposal,	Dec. 18
Jan. 10.	Indianapolis, Ind.,	Monument,	Dec. 11
Jan. 14.	Portland, Ore.,	Light Station,	Nov. 27
Jan. 14.	Columbus, O.,	Garbage Works,	Dec. 4
Jan. 18.	New York, N. Y.,	Dry Dock,	Dec. 18
Jan. 9.	Fort Huachuca, Ariz.,	Swimming Pool,	Dec. 18
Jan. 10.	Wilmington, N. C.,	Dump Scows,	Dec. 18
Feb. 11.	St. Louis, Mo.,	Garbage Reduction.	Dec. 18
May 1.	Buenos Aires, Argentina,	Subways,	Nov. 20

Excavation, Earth and Rock.

Dec. 20.	Mount Vernon, Ind.,	Drainage Work,	Dec. 4
Dec. 23,	Montreal, Que.,	Railroad Work,	Dec. 11
Jan. 7.	De Smet, S. Dak.,	Ditch Work,	Dec. 11
Jan. 11.	Washington, D. C.,	Dredging,	Dec. 18
Jan. 16.	Detroit, Mich.,	Dredging,	Dec. 18
Feb. 1.	Ottawa, Ont.,	Trent Canal,	Dec. 18

Materials, Machines, Supplies, Tools, Etc.

Dec. 18.	Baltimore, Md.,	Window Guards, Gates,	Dec. 11
Dec. 18.	Baltimore, Md.,	Pipe Cement, Etc.,	Dec. 11
Dec. 19.	Pittsburg, Pa.,	Boilers, Generator Sets, Etc.,	Dec. 11
Dec. 19.	Chicago, Ill.,	Cement, Sewer Pipe, Etc.,	Dec. 11
Dec. 20.	Ashville, O.,	Arc Lamps, Wire,	Dec. 4
Dec. 20.	Chicago, Ill.,	Heating Apparatus,	Dec. 11
Dec. 20.	Chicago, Ill.,	Freight Elevator,	Dec. 11
Dec. 21.	Washington, D. C.,	Dump Barges,	Nov. 27
Dec. 21.	Milwaukee, Wis.,	Fire Engine Boilers,	Dec. 18
Dec. 21.	Milwaukee, Wis.,	Fire Engine,	Dec. 18
Dec. 21.	Chicago, Ill.,	Fire Alarm Cables,	Dec. 18
Dec. 23.	Washington, D. C.,	Electrical Materials,	Dec. 4
Dec. 26.	Annapolis, Md.,	Tile,	Dec. 18
Dec. 27.	Washington, D. C.,	Pipe, Chain, Rope, Etc.,	Dec. 4
Dec. 27.	New York, N. Y.,	Vacuum Cleaning System,	Dec. 11
Dec. 27.	Brooklyn, N. Y.,	Timber,	Dec. 18
Dec. 28.	Chicago, Ill.,	Switchboard, Etc.	Dec. 18
Jan. 2.	Washington, D. C.,	Steam Gages, Valves, Etc.,	Dec. 11
Jan. 2.	Jersey City, N. J.,	Broken Stone, Wire, Etc.,	Dec. 11
Jan. 2.	Winnipeg, Man.,	Pump,	Dec. 18
Jan. 3.	Baltimore, Md.,	Window Guards, Gates,	Dec. 18
Jan. 6.	Washington, D. C.,	Engine, Brick, Etc.,	Dec. 18
Jan. 15.	Manila, P. I.,	Pumps and Motors,	Oct. 30
Jan. 15.	Winnipeg, Man.,	Water Pipe,	Dec. 4
Jan. 15.	Washington, D. C.,	Pumps, Motors, Cranes, Etc.,	Dec. 11
Jan. 15.	Grand Rapids, Mich.,	Stone,	Dec. 18

BIDS ASKED

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Forrest City, Ark.—Until Jan. 2, by T. C. Merwin, County Clerk, for construction of 700 ft. steel highway drawbridge over St. Francis River at Madison. H. N. Pharr, Chattanooga, Tenn., is Engineer.

Greenfield, Ind.—Until Dec. 24, by Wm. I. Garriott, County Auditor, for the construction of one 112-ft. span steel bridge, with concrete abutments, over Sugar Creek, in Center Township; one 75-ft. span, steel bridge, with one 12-ft. span steel and concrete bridge over ditch in Brandywine Township.

Hammond, Ind.—Until Jan. 6, by Commissioners of Lake County, Crown Point, Ind., for construction of swing bridge over Calumet River at Columbia Ave., Hammond.

Waseca, Minn.—Until Jan. 8, by County Commissioners, for constructing several steel bridges.

Wayne, Neb.—Until Jan. 10, by County Clerk, for the building and repairing of all bridges required to be built or repaired in the county during 1908.

West Union, O.—Until Jan. 3, by Auditor of Adams County, for the construction of a superstructure of a bridge, over Cherry Fork Creek. Also for the construction of a superstructure of a bridge over Lick Fork of Brush Creek to connect the terminus of the Killinstown and Vaughen Chapel Turnpike.

Grants Pass, Ore.—Until Jan. 2, by County Court for constructing steel bridge, 400 ft. long, over Rogue River.

Bartlesville, Okla.—Until Dec. 20, by J. H. Gorden, County Clerk, for the erection of six wagon bridges.

Pitcairn, Pa.—Until Dec. 20, by Borough Clerk, for construction of reinforced concrete bridge.

Norfolk, Va.—Until Dec. 20, by W. T. Brooke, City Engineer, for construction of culvert at intersection of Redgate Ave. and Greenway Court, Sixth Ward. Bond for $1,200 required of successful bidder.

Victoria, B. C.—Until Dec. 31, by F. C. Gamble, Public Works Engineer, for superstructure metal for swing bridge, North Arm, Fraser River.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Smith, Ark.—Until noon, Jan. 11, by Board of Education at office of A. Klingensmith, Architect, 318-19 Ill. Bldg., Fort Smith, for all labor and materials required by the plans and specifications for the erection of a 16-room two-story basement brick and stone grammar school building.

Punta Gorda, Fla.—Until 3 p. m., Jan. 10, by James Knox Taylor, Supervising Architect, Washington, D. C., for construction of quarters and boathouse at Boca Grande Quarantine Station, Punta Gorda, Fla.

Chicago, Ill.—Until noon, Dec. 27, by Business Manager Board of Education, 730 Tribune Bldg., for closet room additions to Bradwell School, 77th St. and Sherman Ave.; also plumbing and gasfitting, tile sewers and ventilation.

Chicago, Ill.—Until 11 a. m., Dec. 28, by Department Public Works, 322 City Hall, for the construction of a brick and stone isolation hospital, at the southeast corner of 34th St. and Hamlin Ave.

Viola, Kan.—Until Dec. 29, by Chas. J. Dalbom, Clerk, for constructing 2-story, 4-room brick school building for this city.

Minneapolis, Minn.—Until 4 p. m., Dec. 19, by Board of Education, W. K. Hicks, Secretary, for the construction of an addition to the Webster School building, according to plans and specifications on file in the office of E. S. Stebbins, Architect, 614 Masonic Temple.

Trenton, N. J.—Until 3 p. m., Jan. 9, by James Knox Taylor, Supervising Architect, Washington, D. C., for the plumbing and marble finish in toilet rooms, etc., for the U. S. Post Office and Court House building and extension thereto at Trenton.

Santa Fe, N. Mex.—Until 2 p. m., Jan. 13, by Commissioner of Indian Affairs, Washington, D. C., for furnishing labor and materials for constructing office building at Santa Fe School. Further information may be obtained from C. J. Crandall, Superintendent, Santa Fe.

New York, N. Y.—Until 11 a. m., Dec. 20, by Henry H. Sherman, Chairman Executive Committee, Department of Education, Park Ave. and 59th St., for new metal ceilings, plastering, etc., in connection with repairs and alterations, etc., at the annex to the Normal College, East 22nd St.. Security required is $400.

New York, N. Y.—Until 3 p. m., Dec. 26, by C. B. J. Snyder, Superintendent of School Buildings, Park Ave. and 59th St., for alterations of present auditorium on the second and third floors of the board of education, Park Ave. and 59th St. Security required is $10,000.

Philmont, N. Y.—Until Dec. 31, by J. F. Yerrick, Clerk Board of Education, for erection of addition to school building.

Fort Wood, N. Y. H.—Until 11:30 a. m., Jan. 13, by G. C. Burnell, constructing Q. M., for the construction, including plumbing, heating, electric wiring and electric lighting fixtures, of one double set of captains' quarters at this post.

Edwardsville (P. O., Wilkesbarre) Pa.—Until Dec. 30, by E. Lewis, Chairman, for constructing borough hall.

Reading, Pa.—Until Dec. 23, by H. E. Livingood, County Controller, for alterations to county court house.

Fort Monroe, Va.—Until noon, Jan. 13, by Capt. Ernest R. Tilton, Constructing Q. M., for remodeling bathhouses at quarters 84, Fort Monroe.

Milwaukee, Wis.—Until 3 p. m., Dec. 28, by Alvin P. Kletzsch, President, Milwaukee Auditorium Board, room 45, University Bldg., for furnishing all the materials and doing all the work necessary and required to construct and erect an auditorium building on the square or piece of land bounded north by State St., east by Fifth St., south by Cedar St., and west by Sixth St. Ferry & Clas, Architects, 419 Broadway, Milwaukee.

Milwaukee, Wis.—Until 5 p. m., Jan. 2, by Board of School Directors, Frank M. Harbach, Secretary, for materials and doing all the work necessary in razing the old school building and to construct and erect a school building on the northwest corner of Forest Home and 11th Avs., in the 11th ward of the city of Milwaukee.

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Chicago, Ill.—Until 10:15 a. m., Dec. 23, by Board Local Improvements, 216 City Hall, for 8 contracts for paving with vitrified brick, six contracts for paving with granite blocks, 13 contracts for paving with asphalt, four contracts for paving with limestone and three contracts for paving with blast furnace slag.

Crown Point, Ind.—Until noon, Jan. 6, by County Commissioners, for the construction of two gravel roads in North Township.

Danville, Ind.—Until 10 a. m., Jan. 6, by County Commissioners, for the construction of a gravel road, 14,600 ft. long, on the lines between Center and Middle Townships.

Lebanon, Ind.—Until 1 p. m., Jan. 6, by B. F. Simmons, County Auditor, for constructing a gravel road, 29,400 ft. long in Clinton Township and a gravel road 10,600 ft. long in Marion Township.

Logansport, Ind.—Until 10 a. m., Jan. 6, by George W. Cann, County Auditor, for constructing gravel road in Deer Creek Township, road to be about five miles long.

Noblesville, Ind.—Until 10 a. m., Jan. 11, by N. W. Cowgill, County Auditor, for grading, draining and graveling Wm. Singleton et al road, at an estimated cost of $3,401, and for similar improvement of Enoch R. Worley et al road at estimated cost of $3,610.

Tipton, Ind.—Until Jan. 2, by Trustees First Baptist Church, E. A. Jackson, Treasurer, for construction of new church.

Vincennes, Ind.—Until 2 p. m., Jan. 7, by John T. Scott, County Auditor, for the construction of 104,602 ft. of gravel road in Decker Township and 10,567 ft. of gravel road in Vincennes Township.

Baltimore, Md.—Until 11 a. m., Dec. 27, by Commissioners for Opening Streets, Hoen Bldg., to grade, curb, gutter and pave with bitulithic asphalt blocks, vitrified bricks or sheet asphalt Konig St., from Linden Ave. to Bolton Ave.

Fort Washington, Md.—Until 2 p. m., Jan. 18, by Constructing Q. M., for resurfacing macadam roads at this post.

Kansas City, Mo.—Until 3 p. m., Dec. 23, by Frank P. Gossard, Secretary Board Park Commissioners, for grading portion of Lydia Ave.

New Brunswick, N. J.—Until 11 a. m., Dec. 27, by County Freeholders, M. Irving Demarest, Clerk, for the construction of seven stone and gravel roads of an aggregate length of 62,409 ft. Morgan F. Larson, County Engineer, 121 Smith St., Perth Amboy, N. J.

Cleveland, O.—Until 11 a. m., Jan. 4, by Julius C. Dorn, County Clerk, for the grading, draining and paving of Dille Road, from its intersection with the Lake Shore boulevard and Gilbert Ave. to Euclid Road. Bids are also asked until same date for grading, draining and paving of Fisher Road from city limits to west line of Bedford Township. A. B. Lea, County Engineer.

Lisbon, O.—Until Jan. 4, by County Auditor, for grading road leading from East Liverpool to Lisbon.

Dorranceton (P. O., Wilkesbarre) Pa.—Until 7 p. m., Dec. 23, by Town Council for grading, curbing and paving with U. S. creoresinate wood block portion of James St., and for grading, curbing and paving with vitrified fire clay paving block portion of Dorrance St. Smith & Welles, Engineers, 1003 Coal Exchange Bldg., Wilkesbarre, Pa.

Washington, Pa.—Until noon, Jan. 17, by County Commissioners, H. R. Campbell, Clerk, for the construction of improved road bed, culverts, bridges, etc., on the Dry Run road leading from Monongahela to Gingerhill, length three miles. Wm. Wylie, County Road Engineer.

Milwaukee, Wis.—Until 10:30 a. m., Dec. 20, by Board Public Works, Charles J. Poetsch, Chairman, for grading, paving with brick, 5th St., from Grand Ave. to Fowler St.; certified check for $2,200 required with bid. Bids are also asked for grading and paving with asphalt 5th St., from Grand Ave. to Wells St.; certified check for $700 required with bid.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Durango, Colo.—Until 9 p. m., Jan. 6, by Mayor Herman Berndt, for constructing three sanitary sewers to include about 1,100 ft., 10-in. vitrified pipe sewer and 9,020 ft. of 8-in. vitrified pipe sewer, manholes, flushtanks, etc.

Decatur, Ill.—Until 2 p. m., Dec. 18, by Board Local Improvements, for constructing 850 lin. ft. of 12-in. vitrified tile sewer.

Kankakee, Ill.—Until 4 p. m., Dec. 18, by Board Local Improvements, Fred Mann, Chairman, for constructing lateral sewer from Water St. to Walnut St.

Toledo, O.—Until noon, Dec. 23, by Reynold Voit, Secretary Board Public Works, for labor and material for construction of Main sewer No. 1,018.

Youngstown, O.—Until noon, Dec. 27, by Board Public Service, W. H. M'Millin, Clerk, for constructing sewer in Mahoning Ave., from city limits to Mahoning River.

Milwaukee, Wis.—Until 10:30 a. m., Dec. 23, by Board Public Works, Charles J. Poetsch, Chairman, for constructing a concrete sewer in and along Greenfield Ave., from the Kinnickinnic River to a point 655.35 ft. east of Barclay St., in the south sewerage district. Certified check for $2,200 required with bid.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Leavenworth, Kan.—Until 11 a. m., Dec. 27, by Capt. J. E. Normoyle, Constructing Q. M., for constructing water mains at this post.

Orange, N. J.—Until noon, Jan. 1, by Willett B. Gano, City Clerk, for suction and delivery pipe connections of pumping engine at Chestnut St. pumping station. Bids are also asked for steam and feed water piping at above station.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Dredging.—Until noon. Jan. 11, by Major Spencer Cosby, U. S. Engrs., 22d and K Sts., N. W., for dredging in Rappahannock River, Va.

Detroit, Mich.—Dredging.—Until 3 p. m., Jan. 16, by Col. Chas. E. L. B. Davis, U. S. Engrs., for dredging Saginaw River, Mich.

Ottawa, Ont.—Trent Canal.—Until 4 p. m., Feb. 1, by Department of Railways and Canals, L. K. Jones, Secretary, Ontario, for the works connected with the construction of Section No. 2, Ontario-Rice Lake Division of Trent Canal. Plans, etc., at office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Trent Canal, Peterboro.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Huachuca, Ariz.—Swimming Pool.—Until 11 a. m., Jan. 9, by C. A. H. McCauley, Chief Q. M., Denver, Colo., for constructing a swimming pool at Fort Huachuca.

Chicago, Ill.—Gasoline Lights.—Until noon, Dec. 21, by William Carroll, City Electrician, 12 City Hall, for furnishing the city with gasoline lights on certain parts of streets in different sections of the city, for and during the year 1908.

Fort Benjamin Harrison, Ind.—Fence.—Until 2 p. m., Dec. 21, by Geo. H. Penrose, Q. M., for constructing iron fence for corral at this post.

St. Louis, Mo.—Garbage Reduction.—Until

Feb. 11, by Board Public Improvements, W. B. Dryden, Secretary, for Letting No. 8878—furnishing tools, labor, machinery and buildings for reduction of garbage for term ending Sept. 1, 1918. Successful bidder will be required to erect and maintain two receiving stations, each of a capacity of 300 tons in eight hours; approaches, drives, platforms and unloading appliances; and will erect on site of not less than five acres and not less than one mile outside of city limits, adjacent to Mississippi river or railroad, a reduction plant having a reduction capacity of not less than 400 tons daily.

Wilmington, N. C.—Dump Scows.—Until noon, Jan. 10, by Capt. Earl T. Brown, U. S. Engrs., for two 6-pocket bottom dump scows.

New York, N. Y.—Dry Dock.—Until 11 a. m., Jan. 18, by the Bureau of Yards and Docks, Navy Department, Washington, for furnishing the labor and material necessary to complete the granite and concrete dry dock at the navy yard, New York, N. Y., now about 15 per cent completed.

Syracuse, N. Y.—Garbage Disposal.—Until 1:30 p. m., Dec. 23, by Board Contract and Supply, Frederick T. Pierson, Clerk, for disposing in a sanitary manner of city garbage for a period of one year.

Reading, Pa.—Garbage Disposal.—Until Jan. 7, by Caleb Weidner, City Clerk, for garbage disposal.

Fort Monroe, Va.—Vessel Repairs.—Until 9 a. m., Dec. 20, by Lieut. L. B. Magruder, Acting Q. M., for repairs to U. S. mine planter, "Major Samuel Ringgold."

Richmond, Va.—Gas Mains.—Until 4 p. m., Dec. 30, by W. P. Knowles, Superintendent City Gas Works, City Hall, for furnishing the pipe and all labor and material required for the construction of 6, 10, 12 and 20-in. gas mains, to be installed in certain streets in Richmond. Bidders may also estimate separately in furnishing pipe, specials and valves, f. o. b. Richmond, or laying the same, or for digging and refilling trenches, as per specifications.

Charlestown, W. Va.—Street Lighting.—Until Jan. 1, by this city, for street lighting for term of one year from Feb. 1, 1908. Chas. A. Johnson, City Clerk.

L'Anse a La Barbe, Que.—Wharf.—Until Dec. 21, by Fred. Gelinas, Secretary Department Public Works, Ottawa, Ont., for constructing wharf at this place.

St. Omer, Que.—Wharf.—Until Dec. 21, by Fred. Gelinas, Secretary Department Public Works, Ottawa, Ont., for constructing public wharf at this place. J. L. Michaud, Resident Engineer, Merchants' Bank Bldg., Montreal.

Materials, Machines, Supplies, Tools, Etc.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Engine, Brick, Etc.—Until 10:30 a. m., Jan. 6, by H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Circular 408, supplies among which are the following: Engine and generator, switchboard, turning mill, journal boxes, common brick, lumber, etc.

Chicago, Ill.—Fire Alarm Cables.—Until 11 a. m., Dec. 21, by William Carroll, City Electrician, 12 City Hall, for furnishing fire alarm cable as follows: 7,500 ft., 50 pair, No. 19 B. & S. G., saturated paper insulated, lead encased, cable; 6,800 ft., 30 pair, No. 19 B. & S. G., saturated paper insulated, lead encased, cable.

Chicago, Ill.—Switchboard, Etc.—Until 11 a. m., Dec. 28, by William Carroll, City Electrician, 12 City Hall, for furnishing, erecting, and installing in the H. N. May municipal electric lighting station, Fullerton Ave. and the Chicago River, one switchboard and accessories, including all the necessary meters, oil switches, other switches, lightning arresters, and all other necessary equipment.

Annapolis, Md.—Tile.—Until 10 a. m., Dec. 26, by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Naval Academy, Annapolis, Md., a quantity of tile. Applications for proposals should refer to Schedule 604.

Baltimore, Md.—Window Guards, Gates.—Until 3 p. m., Jan. 3 (extension of date from Dec. 18), by James Knox Taylor, Supervising Architect, Washington, D. C., for iron window guards and gates for U. S. Custom House, Baltimore.

Grand Rapids, Mich.—Stone.—Until 3 p. m., Jan. 15, by Major Charles Keller, U. S. Engrs., 57 Park St., Grand Rapids, for furnishing stone for pier filling and riprap at various harbors on eastern shore Lake Michigan.

Brooklyn, N. Y.—Timber.—Until 9:45 a. m., Dec. 27, by Board of Health, 55th St. and 6th Ave., New York, for furnishing and delivering timber, lumber, etc., to the Kingston Ave. Hospital, Brooklyn, during the year 1908.

Richmond, Va.—Gas Mains.—See Under Bids Asked—Miscellaneous.

Milwaukee, Wis.—Fire Engine.—Until 10:30 a. m., Dec. 21, by Board Public Works, Charles J. Poetsch, Chairman, for furnishing city fire department with one second size steam fire engine.

Milwaukee, Wis.—Fire Engine Boilers.—Until 10:30 a. m., Dec. 21, by Board Public Works, Charles J. Poetsch, Chairman, for furnishing two steam fire engine boilers, one for a first size and one for a second size Ahrens engine.

Winnipeg, Man.—Pump.—Until Jan. 2, by Board of Control, M. Peterson, Secretary, for furnishing and installing pumping and air compressing machinery for Well No. 7.

CONTRACTS LET.

The following contracts have been let recently:

Little Rock, Ark.—Interurban Grading.—Perry & Linville, Lamar, Colo., for grading 25 miles of line of Little Rock & Pine Bluff Traction Co.'s line. Work on this section has already been commenced at point 25 miles from this city. The contract for the completion of the line into Pine Bluff was let to Sims Bros., and work will be started by them soon.

Berkeley, Cal.—Wharf.—Atlantic, Gulf & Pacific Co., San Francisco, Cal., at $74,750 for constructing wharf for this city. Itemized bid was as follows: Repairing old wharf, 2,000 piles, per pile, $6; 100 M ft. lumber in place, per M., $27; 760 ft. 3-pile bent, per foot, $6.80; 2,204 ft. concrete pile approach, $14.50 per foot; main wharf, 408x75 ft., $28,000; inner wharf, 4,040 sq. ft., $1,600; shed, 24x100 ft., $1,165; shed, 16x60 ft., $759; 4,400 ft., 4-in. water pipe, $0.50 per lin. ft.

Oroville, Cal.—Hauling.—Northern Electric Ry., according to reports, has contract from Western Pacific Ry. to haul gravel and cobblestones from dredger dumps at Oroville to Western Pacific ballasting at Sacramento.

Canon City, Colo.—Bridge.—Pueblo Bridge Co., Pueblo, Colo., at $1,700, for constructing steel bridge over Arkansas River at Texas Creek.

Peoria, Ill.—Sewer Extension.—Crescent Contracting Co., at $1,074, for extending levee sewers.

Logansport, Ind.—Road Work.—Gravel road contracts have been awarded by County Commissioners as follows: McCain road, in Washington Township, 2½ miles long, to Carney & Wilburn, $7,500. No. 1 and 3, division of the Duncan Briggs Road, to Frank Justice, $4,899 and $3,373 respectively. No. 2, same road, to Smith & Palmer, $2,650.

Lebanon, Ind.—Road.—Shahan & McCarthy at $4,477, for Thos. H. Shelburne Road in Eagle Township.

Lebanon, Ind.—Road Work.—Geo. T. Miller, at $6,248, for George N. Shelburne Road in Eagle Township; L. J. West, at $8,250, for constructing Lanham and Turner Roads in Marion Township.

Monticello, Ind.—Stone Roads.—County Commissioners have let following contracts for stone roads: C. C. Spencer Road in Union Township, to Wm. Kruse, $11,810; D. M. Kelly Road, Prairie Township, to L. T. Kent, $15,119; Personett Road on line between White and Cass, to John Hall, Logansport, at $8,679; J. D. Brown Road, Jackson Township, to Wm. Kruse, Lafayette, $9,309; M. K. Relff Road, Jackson Township, to Million & Hanna, Monticello, at $8,529; C. A. Ballard Road, on line between Union and Honey Creek, to Dahling & Kellenberger, at $11,240; Jacob Diemer Road, Princeton Township, to J. M. Benson, at $12,438. This contract was sublet to Dobbins, Fox & Burk.

Evansville, Ind.—Sewer.—Heuman-Vineyard Plumbing Co., at 69 cts. per lin. ft., for sewer in 7th Ave.

Indianapolis, Ind.—Sewers.—Julius Keller Construction Co., at $1.78 per lin. ft. for local sewer in 26th St.; Indianapolis Construction Co., at $1.92 per lin. ft. for local sewer in first alley north of 29th St.; Henry Maag, at $1.93 per lin. ft. for local sewer in first alley north of 30th St.; Sheehan Construction Co., at $1.85 per lin. ft. for local sewer in first alley north of 31st St.; Pease & Buzatt, at $1.51 per lin. ft. for constructing local sewer in first alley north of Deloss St.

Arkansas City, Kan.—Bridge.—Topeka Bridge Co., Topeka, Kan., at about $2,375, for concrete bridge over canal on West Madison Ave.

Cadillac, Mich.—Sewage Plant.—Falkenau Electrical Construction Co., 108 LaSalle St., Chicago, Ill., at $13,000, for erecting building and installing machinery for sewage disposal plant of this city.

St. Paul, Minn.—Sewer System.—General Contracting Co., Temple Court, Minneapolis, Minn., at $317,000 for constructing St. Anthony Park sewer system. The contract includes the laying of 66,080 ft. of sewer with 270 catch basins and 267 manholes, running over 20 streets.

Durhamville, N. Y.—Aqueduct.—Theodore F. Kalbfleisch, Glens Falls, N. Y., at $56,093, for construction of aqueduct under Erie Canal, at this place. Work includes 12,000 cu. yds. excavation, 2,400 cu. yds. concrete, 120,000 lbs. metal reinforcement, 2,800 lin. ft. foundation piles, 400 lin. ft. wrought iron pipe railing, etc.

White Plains, N. Y.—Trunk Sewer.—Mack Paving & Construction Co., Land Title Bldg., Philadelphia, Pa., at $1,800,000, for constructing the Bronx Valley trunk sewer, the work including about 12 miles of circular sewer from 3 1-3 ft. to 6 ft. in diameter and about three miles of circular lined tunnel mostly 6½ ft. and 8½ ft. in diameter. The sewer is to be either monolithic reinforced concrete, reinforced concrete blocks or brick masonry. Bids were opened Nov. 27.

Dayton, O.—Sewers.—John T. Reese, at $72,898, for constructing sanitary sewers in District No. 3, including all of North Dayton. Work includes about 11 miles of mains and sewage pumping station.

Youngstown, O.—Sewer—Anthony O'Hara, at $3,603, for constructing sewer in Rigby St.

Orrville, O.—Sewer System.—John Skeeles, Canton, O., at about $85,000, for constructing 16 miles of sanitary sewers for this place.

Mont Alto, Pa.—Cottages.—Charles W. Denny, 1330 Arch St., Philadelphia, Pa., at $56,268, for 40 4-room cottages, 16 pavilions and 10 toilet houses at Mont Alto Sanitarium.

Erie, Pa.—Street Lighting.—Erie County Electric Co., at 18 cts. per arc light per night for lighting streets.

Olyphant, Pa.—Sewer.—O'Boyle Bros., Dunmore, Pa., for constructing Third ward sewer.

Philadelphia, Pa. — Garbage Disposal. — Penn Reduction Co., at $488,988, for disposing of city garbage during 1908.

Fort Worth, Tex. — Bridge. — Leveredge Bridge & Construction Co., for constructing 96 ft. long concrete bridge over Tyler Branch for County.

Newport News, Va.—Steamboats. — Newport News Dry Dock & Ship Building Co., at $600,000 for constructing two steamboats for the Washington Steamboat Co., John Callahan, General Manager, Washington, D. C.

Pleasant Prairie, Wis.—Bridge.—Wisconsin Bridge & Iron Co., Milwaukee, Wis., for new bridge over O'Phane River for Kenosha County.

PROJECTED WORK.

Bridges.

Items Arranged Alphabetically by States.

Tucson, Ariz.—County Commissioners will erect a bridge over the Rillito at a cost of $7,000.

Pine Bluff, Ark.—Missouri Pacific Ry., E. W. Wiggin, Engineer of Bridges and Buildings, St. Louis, Mo., and the St. Louis Southwestern Ry., M. L. Lynch, Chief Engineer, Tyler, Tex., are to build steel viaduct over their tracks in the eastern suburbs of this city. Viaduct will run over Ohio St., and will extend from E. 2nd Ave. to E. 6th Ave., four blocks.

Redwood City, Cal.—Supervisors of San Mateo and Alameda Counties are considering erection of a wagon bridge over San Francisco bay alongside of the Dumbarton bridge to connect the two counties. Estimated cost of bridge is $250,000, and city of San Francisco is to be asked to share expense of surveys for the road. John H. Coleman is Chairman Supervisors of San Mateo County.

Winsted, Conn.—Grade crossing at Forest View Cemetery is to be eliminated by construction of concrete or steel bridge. Committee, Col. W. B. Smith, member, is considering matter.

Washington, D. C.—Bill is before Congress providing for bridge over Rock Creek at Q St.

Havre de Grace, Md.—Plans for the new Baltimore & Ohio R. R bridge over the Susquehanna River between this place and Perryville have been approved and the company will shortly commence active work. W. S. Bouton, Baltimore, Md., is Assistant Engineer Bridges and Building, B. & O. R. R.

Danforth, Me.—Maine Central R. R., B. W. Guppy, Bridge Engineer, Portland, Me., according to reports, proposes to erect a new bridge over the Baskahegan River at this place.

Kansas City, Mo.—Park Board, W. H. Dunn, Superintendent of Parks, is considering the erection of two concrete bridges over Blue River in Swope Park.

Auburn, N. Y.—County Supervisors are considering construction of two steel bridges over Seneca River to replace the present wooden structures.

Brighton, N. Y.—Town Board is considering construction of bridges over New York Central tracks at Clover St. extension. Bridge would cost about $20,000, one-half of which would be by the railroad and the remainder by the State and Town. W. P. Surgenor is Town Clerk.

New York, N. Y.—Following bids were received Dec. 9, by James W. Stevenson, Commissioner of Bridges, 13 Park Row, for the construction of the masonry piers, surface and and sub-surface changes, and steel superstructure of the Manhattan and Brooklyn approaches of the Manhattan bridge over East River, between the Boroughs of Manhattan and Brooklyn: John C. Rogers, 13 Park Row, $2,167,000; Williams Engineering Co., 13 Park Row, $2,416,820; McClintock-Marshall Construction Co., 13 Park Row, $2,667,978; Maryland Steel Co., 71 Broadway, $2,179,000.

Akron, O.—Cleveland, Akron & Columbus Ry., A. B. Jones, Engineer Maintenance of Way, Akron, O., has asked City Council for permission to reconstruct the bridge over the company's tracks and the tracks of the B. & O. R. R. and the Erie on East Market St., near the Union Depot.

Philadelphia, Pa.—Council's Survey Committee has recommended the construction of the following bridges: Woodland Ave., over Cobb's Creek, $18,000; Belfield Ave., under Tabor Branch Philadelphia & Reading R. R., $50,000; Large St., under Frankford Branch Philadelphia and Reading, $20,000; Boulevard bridge, over Philadelphia & Bustleton R. R., $50,000; boulevard bridge, over Philadelphia & Frankford R. R., $50,000; Hunting Park Ave., over P. N. and N. Y. R. R., $40,000; Rockland St., over North Penn R. R., $40,000; 61st St., over Baltimore & Philadelphia R. R., $15,000; Sedgewick St., under Chestnut Hill Branch Philadelphia & Reading Ry., $35,000; Ontario Sts., under Richmond branch Philadelphia & Reading, $40,000; Roberts Ave., under P. G. & C. H. R. R., $20,000; 54th St., over P., W. & B., $22,000; 62d St., over P. W. and B., $32,000; 42d St., over Pennsylvania R. R., $112,000; Passyunk Ave. bridge, $200,000.

Railroads

Items Arranged Alphabetically by States.

Nashville, Ark.—A $500,000 bond issue of the Memphis, Paris & Gulf R. R., which extends from this place to Ashdown, Ark., has been floated. The road will use the money in building two extensions—one extending west from Ashdown to Clarksville and Paris, Tex., and the other extension from Nashville to the Bemis Road, eight miles. W. W. Brown, Camden, Ark., is interested.

San Rafael, Cal.—Building operations are to be commenced early next year by the A. T. & S. Fe Ry. and the Southern Pacific Ry. on the construction shops to be erected in this city. The plans call for an expenditure of $600,000. H. C. Phillips, Los Angeles, Cal., is Chief Engineers A. T. & S. Fe Ry.

Stockton, Cal.—Southern Pacific Ry. has asked permit from City Council to install another track along the side of its main line through Stockton and also that additional spurs be permitted along the road. For some time the railroad has been working on the proposition of double tracking its road from Tracy to Sacramento, and the application noted above is said to be tho final move before work is commenced. W. Hood, Sacramento, Cal., is Chief Engineer.

Denver, Colo.—Reports from this city state that the Chicago, Rock Island & Pacific Ry., J. B. Berry, Chief Engineer, Chicago, Ill., is planning to build its own tracks between Colorado Springs and this city, where it will establish terminals, and also between Denver and Limon Junction. According to the report surveys for the line between Denver and Colorado Springs have already been completed and a route is now being located between the former city and Limon. It is also said that options are being secured on land in Denver to be used for the terminals.

Atlanta, Ga.—Since Jan. 1 charters have been issued to the following railroads, some of which have been previously noted in these columns: Savannah, Augusta, Northern Ry. Co., headquarters Statesboro, Ga.; capital $8,000,000; Thomasville & Northeastern Ry., Thomasville, Ga., $75,000; Atlanta, Stone Mountain & Lithonia Ry.; Stone Mountain, Ga., $50,000; Savannah & Southeastern R. R., Savannah, Ga., $7,000,000; Fitzgerald, Ocilla & Broxton R. R., Fitzgerald, Ga., $100,000; Florida Central R. R., Thomas County, $50,000; Ocilla, Pinebloom & Valdosta R. R., Pinebloom, Ga., $200,000; Gulf Line Ry., Atlanta, Ga., $400,000; Bainbridge Northeastern Ry., Bainbridge, Ga., $200,000.

Wichita, Kan.—Kansas City, Mexico & Orient Ry., M. P. Paret, Chief Engineer, Kansas City, Mo., is stated to have let contract for 4,000 tons of steel rails to be used in completing the road between this place and the Red River, 22 miles.

Roosevelt, Minn.—W. T. Hunt, proprietor of the New Brunswick Stock Farm, Roosevelt, is reported to be promoting project for building a railroad from Roosevelt to Thief River Falls, Minn., 83 miles.

Fromberg, Mont.—Advices from this place state that stockholders of the Big Horn R. R., a branch of the C., B. & Q. Ry., have authorized the extension of the road from Frannie to Fromberg. Surveys have been completed and it is expected that construction work will be started in the spring. I. S. P. Weeks, Lincoln, Neb., is Engineer C., B. & Q. Ry.

Omaha, Neb.—Missouri Pacific Ry. is to at once commence the entire reconstruction of the Omaha Belt Line R. R., from Walnut Hill to 24th St., as well as the entire line to South Omaha, a distance of eight miles. This railway is already engaged in reconstructing 85 miles of its Nebraska systems. The work is to be done under the direction of Frederick H. Van Craenenbroeck, Division Engineer, Omaha, Neb.

Toledo, O.—The proposed reorganization of the Toledo Ry. & Terminal Co., of which T. B. Fogg, Toledo, is General Manager, includes the organization of a new company under the laws of Ohio, with a capital stock not exceeding $6,000,000. Of this amount it is proposed to set aside $2,000,000 to be used for extensions, acquisitions and other corporate purposes.

Pittsburg, Pa.—Directors of the New York, Pittsburg & Chicago R. R., the line planned by Joseph Ramsey, Jr., former President of the Wabash, have authorized the sending out of five corps of engineers to make a complete revision of the line between Pittsburg and the summit of the Allegheny Mountains. This is said to be preparatory to beginning work on actual construction next spring. At the same meeting Mr. Ramsey was elected President of the company. It is stated that details of the plans have been completed, even to the arrangements for an entrance into Pittsburg, and that the line would be in operation within five years. Financiers of Europe, as well as America, are said to be back of the enterprise.

Chattanooga, Tenn.—Advices from this city state that the Louisville & Nashville R. R. will be extended from Etowah to this city, a distance of 50 miles. W. H. Whigton, former Superintendent of the Soddy Coal Co., has been engaged to look after the details. The line will cost $1,000,000. W. H. Courtenay, Louisville, Ky., is Chief Engineer, L. & N. R. R.

Dickson, Tenn.—Nashville, Chattanooga & St. Louis Ry., J. H. Peebles, Superintendent, Nashville, Tenn., proposes to double track its line from Dickson to Colesburg, two miles.

Nashville, Tenn.—Grading on roadbed of extension of Tracy City branch of Nashville, Chattanooga & St. Louis Ry., H. McDonald, Chief Engineer, Nashville, is about completed and track laying will be started about Jan. 1.

Jewett, Tex.—Trinity & Brazos Valley Ry., P. G. Burns, Chief Engineer, Fort Worth, Tex., has let a contract for a 5½ mile spur line from this place to Dowie, the object being to develop lignite mines in Limestone County. Cost of spur will be about $50,000.

Appleton, Wis.—Surveys are under way near this place for the new line of the Wisconsin & Northern R. R., of which W. Cambier, Oshkosh, Wis., is Chief Engineer.

Cambridge, Wis.—Chicago & Lake Superior Ry., B. L. Delamater, President, Cambridge, Wis., which operates a four-mile line between this place and London, is planning to build a 25 mile extension to Janesville.

Madison, Wis.—Lake Superior & Southern Ry., mentioned in our last issue, proposes to build 300 miles of railroad from Madison, north to Champion, Marquette County, Mich., thence northwest to Huron Bay on Lake Superior. Much preliminary work has already been done. The first section to be constructed will extend from Huron Bay to Champion, 35 miles.. The grading of this stretch of line is already completed, the route being that of the old Huron Bay R. R., built and abandoned many years ago, and many of the bridges and culverts formerly in use are in serviceable condition. M. C. Philips, Oshkosh, Wis., is President.

Electric Railways.

Items Arranged Alphabetically by States.

Denver, Colo.—Committee on Public Improvements of the Real Estate Exchange, is considering project for the construction of an electric railway from this city to Mount Morrison. The project being promoted by John Brisben Walker, who is constructing a railway to the summit of Mount Morrison. As proposed the line from Denver would be 14 miles long.

Pueblo, Colo.—Surveys for the projected line of the Pueblo & Arkansas Valley Electric Ry., between this city and Fowler are practically completed. The project is being promoted by M. Douthitt.

Atlanta, Ga.—Since Jan. 1, 1907, charters have been granted to the following electric railways, some of which have been mentioned in these columns: Macon, Americus & Albany Electric Ry., Macon, Ga., $200,000; Georgia Electric Ry., Fulton County, $10,000; Tennessee & Georgia Interurban R. R., Ringgold, Ga., $500,000; Quitman, Valdosta & Thomasville Electric Ry. & Power Co., Quitman, Ga., $30,000; Americus Railway & Light Co., Americus, Ga., $250,000.

Gillespie, Ill.—Gillespie Electric Ry. Co., capital stock of $30,000, has been incorporated and proposes to construct and operate a railroad from Gillespie to mines in Macoupin County, Ill. The incorporators and first Board of Directors are H. T. Bycroft, R. H. Isaacs, H. W. Rice, G. W. Schmidt and S. P. Preston, all of Gillespie, Ill.

Quincy, Ill.—At recent meeting of stockholders of St. Louis, Terre Haute & Quincy Electric Ry., it was voted to transfer headquarters of company from Springfield to Quincy, Ill. The company proposes the construction of an interurban line between the points named. Edward Yates, Pittsfield, Ill., is President and F. W. Kollenberg, Quincy, Ill., is Secretary and Treasurer.

Wabash, Ind.—Press reports from this place state that Marion & Logansport Traction Co. is to have surveys started about Jan. 1 for its line.. All rights of way and franchises have been secured. According to the report James R. Poole, Wilson Block, is President.

Paducah, Ky.—According to advices from this place all rights of way and franchises for the Southern Electric Ry. Co. between Paducah and Mayfield have been secured and the company is negotiating with an engineering company to make the survey and estimates.

Natick, Mass.—Boston & Worcester Street Ry. has been granted permission to build a branch line connecting the central part of Natick with the main line.

Duluth, Minn.—S. F. Snively, C. P. Craig and John G. Williams are promoting a project for the construction of an electric railway, 6 miles long, to extend from Woodland Ave. to Jean Du Lach Farm.

Winston-Salem, N. C.—Council has passed ordinance granting the right of way into the city for the proposed interurban railway from High Point to Winston-Salem.

Lincoln, Neb.—The Commercial Club has taken up a project for the construction of an electric railway between Lincoln and Falls City, and has named committees to visit various towns on the proposed line to confer with local business organizations. The line, which is being promoted by J. N. Wilson, of Cincinnati, would cost about $4,000,000 to construct. J. H. Miles, Falls City, Neb., is also interested.

Minealo, N. Y. (L. I.)—County Supervisors have been asked by the New York & North Shore Traction Co., formerly the Mineola, Roslyn & Port Washington Traction Co., for a franchise to build a trolley line on the North Hempstead and Flushing

Turnpike at its intersection with the Middle Neck road, at Appleby's Corner, Roslyn, west to the easterly limits of New York.

Elizabeth, Pa.—A charter has been granted to the Monongahela & Carroll Street Railway Co. to build an electric line from Monongahela up Pigeon Creek to Bentleysville and ultimately to Washington. W. D. McBryar of Elizabeth is one of the incorporators.

New Castle, Pa.—The Beaver Falls & Koppel Electric Ry. Co., and the Beaver & Lawrence Electric Ry. Co. have been chartered, according to advices from this place. The Beaver and Lawrence line will begin in North Sewickley, just on the boundary between Beaver and Lawrence Counties, and will be built as far as Beaver Falls. The other system will extend from Beaver Falls to Koppel, a distance of about 10 miles. T. P. Simpson, S. L. Tone, C. W. Gibbs, W. J. Horgan and B. S. Johns are interested.

Electric and Gas Plants.

Items Arranged Alphabetically by States.

Fort Smith, Ark.—The Nelson Investment Co., J. T. Nelson, President, has been incorporated with a capital stock of $100,000 to construct an electric lighting plant, etc.

Needles, Cal.—C. F. Schader has been granted franchise for gas plant in this city.

Pasadena, Cal.—City will probably vote on two propositions regarding electric plant. One of these provides for expenditure of $50,000 in finishing up system outlined for street purposes, and the other provides that $150,000 be expended in equipping the plant for commercial lighting.

Loveland, Colo.—Local Chamber of Commerce is considering building a municipal lighting plant.

Aguilar, Colo.—Hawkins & Barnett, Trinidad, Colo., have been granted franchise for electric light and power plant here, and will expend $25,000 in the work.

Tulsa, Ind. T.—The Tulsa Corporation, which controls local electric and power plant, water system, and an ice and packing plant, will expend $100,000 for improvements to include a large electric plant and an ice plant.

Topeka, Kan.—A $50,000 bond issue will be made for improving city electric light plant.

Morehead, Ky.—City is to erect electric light plant to cost $10,000. Reliance Engineering Co., Cincinnati, O., has plans under way.

Charlotte, Mich.—Michigan Power Co. has asked City Council for street lighting franchise.

Faribault, Minn.—The Scott mill and water power, located several miles north of this city on the Cannon River, purchased in connection with the Polar Star electric light and power plant in this city, by the Northern Heat & Electric Co., of St. Paul, will be greatly improved during the coming season.

St. Louis, Mo.—The Union Electric Light & Power Co. has increased its capital stock from $10,000,000 to $18,000,000.

St. Louis, Mo.—Residents of Overland Park, a suburb of this city in St. Louis County, have formed a stock company for the purpose of installing an electric plant.

St. Louis, Mo.—Baden Power Co. has been incorporated with a capital stock of $2,000. Robert Gaylord, of Chicago, Ill.; George S. Gaylord, of Evanston, Ill.; James A. Seddon, Warren D. Harris and Samuel B. McPheeters, are interested.

Omaha, Neb.—Advices from this city state that the Nebraska Power Co. has been organized with H. E. Babcock as President and F. Jaeggi as Vice President.

Pender, Neb.—City is figuring on installing an electric light plant.

Bergholz, O.—The Bergholz Electric Light & Power Co. of this city has been incorporated with a capital stock of $10,000 by William E. Steinmetz, James B. Marshall and S. W. Dorrance.

Wasco, Ore.—George E. Jacobs, Portland, Ore., has purchased water power rite in Deschutes River and proposes to furnish towns of Moro, Wasco and Grass Valley in Sherman County with electricity for power and lighting purposes.

Reading, Pa.—Board of Education proposes to install electric light plant to light the Boys' High School at a cost of $5,000.

Puyallup, Wash.—Fuller & Manley, Tacoma, Wash., are preparing estimates for municipal lighting for this place.

Sewers.

Items Arranged Alphabetically by States.

Albany, Ga.—City may vote on issuing $25,000 of bonds for constructing storm sewers. R. J. Edgerly is City Engineer.

Athens, Ga.—Election is to be held Jan. 15 to vote on issuing $25,000 of bonds for sewers.

Creston, Ia.—City is to secure engineer to advise means of disposing of sewage from a manufacturing plant.

Galva, Ill.—City Engineer Richey has prepared plans for sewer system for this city to cost about $40,000.

Logansport, Ind.—Plans for storm water sewer on Sycamore St. have been completed by John Schmidt, City Engineer.

Muncie, Ind.—Trustees of Riverside City (a suburb of this place) propose the construction of two additional sewers.

Iola, Kan.—Improvement of city sewer system is under consideration.

Lawrence, Kan.—Ordinances are before City Council for construction of two main sewers, one in north part and the other in southeast part of town.

Winfield, Kan.—Property owners of west side are considering formation of a sewer district in order to secure lateral sewer for that section. Grant Stafford is interested.

North Andover, Mass.—Plans have been prepared by E. W. Bowditch, Consulting Engineer, Boston, Mass., for a new sewer system for this place. Estimated cost is $300,000 and matter will have to be voted on by citizens at Town meeting in March. The plans have been prepared with a view to use the present sewers as far as feasible. The outlet will be into the Merrimac River a short distance below the mouth of the Shawsheen River.

Albuquerque, N. Mex.—Plans and specifications for complete combined sewer system for city of 50,000 inhabitants has been submitted to City Council by James N. Gladding, City Engineer. Pending the construction of the new system the City Engineer has recommended construction of pumping plant at sewer outlet at a cost of $2,160, divided up as follows: Pumps, $600; freight, $100; motor, $350; pump pit, $350; flume, $750. The City Engineer also recommends that a Consulting Engineer be secured and made a member of a commission, generally composed of three members of the council and the City Engineer to thoroughly overhaul the Engineer's report.

Newton, N. J.—Town has voted against issuing $50,000 additional sewer bonds.

Mansfield, O.—Board Public Service has recommended that the sewer system be extended to the water works station. Cost would be about $7,000.

Steubenville, O.—Board Public Service has recommended that Adams St. sewer be extended from 9th St. to Pleasant Heights.

Wyoming (P. O. Cincinnati), O.—Village Council is considering plans for a sewer system. Riggs & Sherman, The Nasby, Toledo, O., are the Engineers.

Allquippa, Pa.—State Health Department has granted this Borough permit to construct sewer.

Bryn Mawr, Pa.—Bryn Mawr College, M. C. Thomas, President, has been directed to connect its sewer with the sewer system of Lower Merion Township.

Chester, Pa.—Council has approved ordinance for constructing sewer in Edgemont.

Lancaster, Pa.—Permit has been granted this city by State Health Department to construct sewers upon condition that a dam be erected.

McKeesport, Pa.—City is to purchase machine for cleaning sewers.

Water Supply.

Items Arranged Alphabetically by States.

Tucson, Ariz.—Needles Water & Power Co., with capital stock of $1,000,000, has been incorporated by Charles F. Davis and others.

Phoenix, Ariz.—R. A. Craig, Superintendent Water Department of Phoenix, Ariz., advises us that the following bids were received Dec. 2, for the construction of a water works system for the city. Bids were taken on furnishing all materials and labor, for supplying material only, and for installing mains, hydrants, etc. The materials required were as follows, the pipe required being straight lengths of "Hub and Spigot" pipe:

4 in. c. i. pipe,	22 lbs. per ft.,	10,560 lin. ft.
6 in. c. i. pipe,	34 lbs. per ft.,	70,600 lin. ft.
8 in. c. i. pipe,	47 lbs. per ft.,	9,960 lin. ft.
10 in. c. i. pipe,	64 lbs. per ft.,	11,640 lin. ft.
12 in. c. i. pipe,	83 lbs. per ft.,	480 lin. ft.
16 in. c. i. pipe,	133 lbs. per ft.,	5,520 lin. ft.

The hydrants required are to be of Ludlow Valve Mfg. Co. make and are to open at the top; both the 4 in. and 6 in. hydrants are to be rubber faced, slide gate hydrants. In all 27 4-in. and 67 6-in. hydrants are required. The valves are to be of the kind known as Hub end, iron body, bronze mounted, double gate valves, suitable for water test pressures of 300 lbs. per sq. in.; one cast iron extension valve box is to be furnished with each valve. The following quantities are required: 87 4-in. valves; 154 6-in., 13 8-in., 14 10-in., 2 12-in., and 6 16-in. In addition special castings for the work were required. All excavation work is to be in open cut and it is expected that no rock will be encountered. Should rock be encountered the contractor is to be paid actual cost plus 15 per cent for excavating it. The trenches are to be 16 in. wider than greatest diameter of pipe and are to be of sufficient depth to give a uniform cover of at least 2½ ft. above the top of the pipe. The bids received for all materials and labor for the system were as follows, the bid on pipe being per lin. ft., and the bid for valves and hydrants being for each; (1) F. C. Mortimer, Chicago, Ill., (2) T. C. Brooks & Sons, Jackson, Mich.:

	(1)	(2)
4 in. pipe	$ 0.79	$ 0.77
6 in. pipe	1.01	.99
8 in. pipe	1.38	1.34
10 in. pipe	1.77	1.75
12 in. pipe	2.29	2.19
16 in. pipe	3.30	3.30
4 in. valves	16.00	14.00
6 in. valves	24.00	21.00
8 in. valves	31.00	29.00
10 in. valves	43.00	40.00
12 in. valves	53.00	50.00
16 in. valves	106.00	90.00
4 in. hydrants	43.00	37.00
6 in. hydrants	70.00	64.00
Total, not including specials	$145,996.00	$142,325.00

For special castings F. C. Mortimer bid $80 per net ton and T. C. Brooks & Sons bid $75 per net ton.

For furnishing pipe and specials the following bids per ton, f. o. b., Phoenix, were received, the contract being awarded the American Cast Iron Pipe Co.: (1) American Cast Iron Pipe Co., Birmingham, Ala.; (2) Colorado Fuel & Iron Co., Denver, Colo.; (3) U. S. Cast Iron Pipe & Foundry Co., Birmingham, Ala.; (4) A. M. Ozburn, Chicago, Ill.; (5) Dimmick Pipe Co., Birmingham, Ala.:

	(1)	(2)	(3)	(4)	(5)
4 in. pipe	$38.40	$39.50	$39.90	$41.25	$39.45
6 in. pipe	38.40	39.50	39.90	41.25	39.45
8 in. pipe	38.40	39.50	39.90	41.25	39.45
10 in. pipe	38.40	38.50	39.40	41.25	39.45
12 in. pipe	38.40	37.50	39.40	41.25	39.45
16 in. pipe	38.00	37.50	39.40	41.25	39.45
Specials	65.00	67.50	65.00	68.00	64.00
Total, not including specials	$86,747.00	$88,262.00	$89,911.00	$93,334.00	$89,261.00

In addition R. D. Wood & Co., Chicago, Ill., offered the following bid per lin. ft., for furnishing pipe: 4 in., $0.57; 6 in., $0.95; 8 in., $1.38; 10 in., $1.83; 12 in., $2.26; 16 in., $3.43; total not including specials, $128,154; bid for specials was $80 per ton. For furnishing hydrants and valves f. o. b. Phoenix, the following bids were received, the contract for valves being let to Ludlow Valve Mfg. Co., at $5,748, and the contract for hydrants to R. D. Wood Co., at $4,512; (1) R. D. Wood Co., (2) Merkle Machinery Co., Kansas City, Mo., (3) Ludlow Valve Mfg. Co., Troy, N. Y., (4) J. B. Clow & Sons, Chicago, Ill.:

	(1)	(2)	(3)	(4)
4 in. valves	$13.75	$12.25	$13.00	$14.40
6 in. valves	19.25	17.00	19.80	20.50
8 in. valves	27.75	24.00	26.95	29.50
10 in. valves	39.25	34.00	37.85	40.50
12 in. valves	46.25	45.50	46.60	53.50
16 in. valves	94.25	84.00	82.40	83.00
4 in. hydrants	31.00*	.....	33.25†	33.00*†
6 in. hydrants	46.50*	.....	58.75†	60.00*†

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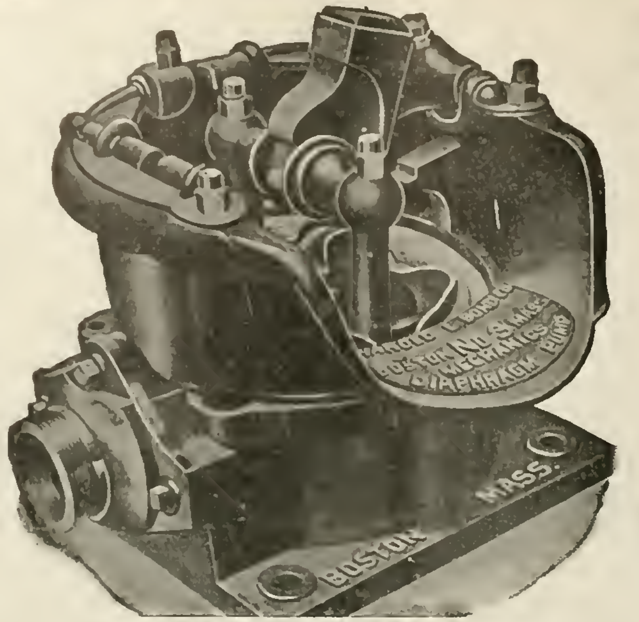
*Matthews hydrants.

†Ludlow hydrants. *†Eddy hydrants.



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For laying pipe per lin. ft., and setting each valve and hydrant the following bids were received: (1) being Chick & White, Berkeley, Cal., and (2) J. B. Girand, Prescott, Ariz.:

	(1)	(3)
4 in pipe	$0.38	$0.39½
6 in. pipe	.39	.44
8 in. pipe	.48	.52
10 in. pipe	.55	.57
12 in. pipe	.61	.62
16 in. pipe	.94	.98
4 in. valves	3.00	1.00
6 in. valves	4.00	1.50
8 in. valves	4.00	2.00
10 in. valves	5.00	2.00
12 in. valves	6.00	2.50
16 in. valves	10.00	2.50
4 in. hydrants	2.50	1.50
6 in. hydrants	4.00	1.75
Total	$49,618.00	53,305.00

All bids for labor and installation were rejected and new bids are being asked until Jan. 10, the official advertisement appearing elsewhere in this issue.

Vallejo, Cal.—Election may be held to vote on issuing $60,000 of bonds for increasing city water supply.

Atlanta, Ga.—City has about $60,000 remaining from $350,000 water works bond issue which will be used to purchase small mains. Park Woodward is General Manager City Water Works.

Dublin, Ga.—A $40,000 bond issue is to be voted on Jan. 8. Part of this sum will be used for enlarging water works and extending sewer.

Berwyn, Ill.—City of Chicago is to extend its water mains to limits of this place to supply water.

Mentone, Ind.—Town Board is seeking to have water works installed here.

Baltimore, Md.—City is endeavoring to obtain permission to issue $5,000,000 of bonds for increasing its water supply. Alfred Quick is Engineer of Water Works.

Marquette, Mich.—City Water Board is reported to be considering removal of water works plant to northwest point of Presque Isle as a means of obtaining a new water supply.

Burlington, N. C.—This place has voted to issue $100,000 of bonds for extension of water works and installing sewers.

Malmo, Neb.—Village Board has appointed a committee to investigate the cost of installing a water works system and electric light plant.

Jersey City, N. J.—Chief Engineer Van Keuren of the Street and Water Commissioners has been directed to draw up plans for two 36-in. water mains under the Hackensack and Passaic Rivers. Estimated cost is $100,000.

Ellwood City, Pa.—Wurtemburg Water Co. has been chartered. Capital stock is $5,000, and A. H. McNames, Pittsburg, Pa., is interested.

Franklin, Pa.—John L. Hanna, Jr., Contractor and Real Estate Dealer, wants address of firm having a system of taking water from a series of wells for municipal purposes.

Warren, Pa.—Citizens of this Borough will vote on purchasing mains and franchises of Warren Water Co.

Hopewell, Pa.—Hopewell Township Water Co., has been chartered with capital stock of $5,000 Howard Flinn, Beaver, Pa., is interested.

Mount Union, Pa.—Mount Union Water Co. has increased its capital stock from $12,500 to $60,000.

Norfolk, Va.—A $50,000 bond issue for purchase of water meters has been authorized.

Terra Alta, W. Va.—The Terra Alta Water Co., capital $10,000, has been incorporated by W. T. White, and others, to supply this town with water.

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RAILWAY WORK.

The J. H. Reynolds Construction Company, successors to J. H. Reynolds, have secured the contract for 150 miles of work in northern Ontario and Quebec, Canada, and will be ready to let the work soon after December 1st, 1907. The work consists of grading (earth and rock, principally earth), mostly steam shovel work to be done with small cars and track, and also concrete work and tie contracts. Address The J. H. Reynolds Construction Company, McDougall Chutes, Ontario, Canada.

U. S. ENGINEER OFFICE, Portland Oreg., Nov. 20, 1907. Sealed proposals fo construction of one stern wheel steamboa will be received here until 11 A. M., Dec 20, 1907, and then publicly opened. Information furnished on application. S. W. Roessler, Lt. Col., Engrs.

U. S. ENGINEER OFFICE, Portland Oreg., Nov. 23, 1907. Sealed proposals fo construction of one wooden hull hydrauli dredge will be received here until 11 a. m. Dec. 23, 1907, and then publicly opened Information furnished on application. S. W Roessler, Lt. Col., Engrs.

READVERTISEMENT.

LAYING WATER PIPE.

Phoenix, Arizona.

Sealed proposals will be received by the Superintendent of the Water Department at the City Hall, Phoenix, Arizona, until four o'clock of January 10th, 1908, for laying cast iron water pipe.

A certified check for five per cent of the amount of the bid, made payable to Frank Thomas, City Recorder, must accompany each proposal.

Specifications may be obtained upon application.

The Superintendent reserves the right to reject any and all bids, and to waive any informalities in any proposal.

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WANTED—Stenographer wants position. Young man with two years' experience. Address "Sten.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

WANTED—Man to take charge of sinking three steel caissons, one 31 ft. and two 15 ft. in diameter; through 60 ft. of water and clay, for foundation of railway bridge at Fort William, Ontario. Man must be steady, competent and experienced in that kind of work; state fully your qualifications, salary expected and how soon you can report. Address at once, Engineering Agency, Monadnock Block, Chicago.

WANTED—Civil Engineer (34) with extensive general contracting, designing, estimating and organizing experience, desires engagement. Address "Box 32," care of Engineering-Contracting, 355 Dearborn St., Chicago, Ill. 25-3t

WANTED—Address of firms having systems of taking water from a series of wells for municipal purposes. J. L. Hanna, Jr., Franklin, Pa.

WANTED—POSITION — Engineer with 13 years' experience; expert locating engineer; also contracting experience; designed large amount of reinforced concrete work; best of references. Address "J. A. B.," care of Engineering-Contracting, 355 Dearborn St., Chicago.

WANTS

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Displayed $1.00 an Inch.

WANTED—Address of party in this vicinity who handles Puzzolan cement. Address "A. B.," care of Engineering-Contracting.

WANTED—Position as manager, superintendent, or chief engineer with railway company or general contractors, by civil engineer of 20 years' broad experience. Short line preferred. Can show results. Two years present position as manager short line. Wish change of location. Address "E. O.," care Engineering-Contracting, 355 Dearborn St., Chicago, Ill. 14tf

WANTED—Two experts on concrete and reinforced concrete construction, design of forms, etc., are open for engagement. Address "Experts," Engineering-Contracting, 355 Dearborn St., Chicago, Ill. 18-tf

TO CONTRACTORS—Wanted to become associated with firms of reliable contractors with the view of carrying out the work of construction of what is likely to become a valuable improvement in Water Filtration Plants—the design of which is fully protected in both countries. Address Box 264, Goderich, Ontario, Canada.

WANTED—To Rent—No. 4 centrifugal pump, to be used for a few weeks in making tests of wells for water supply at Wahoo, Neb. State rental price, location and weight of pump. Address Geo. H. Morse, C. E., Box 1204, Station A., Lincoln, Neb.

WANTED—Graduate Civil Engineer desires position on Pacific Coast. Wide experience land and harbor surveys, underground conduit and telephone construction work, concrete bridge design, canal and levee work, irrigation projects, estimates, etc. First-class references. Address "R. J. S.," 599 S. Tenth St., San Jose, Cal. 24-2t

WANTED — POSITION — Tropics preferred. Efficient engineer and superintendent, recently in charge of extensive public works in South America. Successful in organizing and managing large forces of men. Thorough command of Spanish. Familiar with cost-keeping accounts and records. Experienced in railroad work, road construction, harbor improvements, street paving, sewers, waterworks, dams, canals, drainage and irrigation. Address "E. E. S.," Engineering-Contracting, 355 Dearborn St., Chicago. 23-8t

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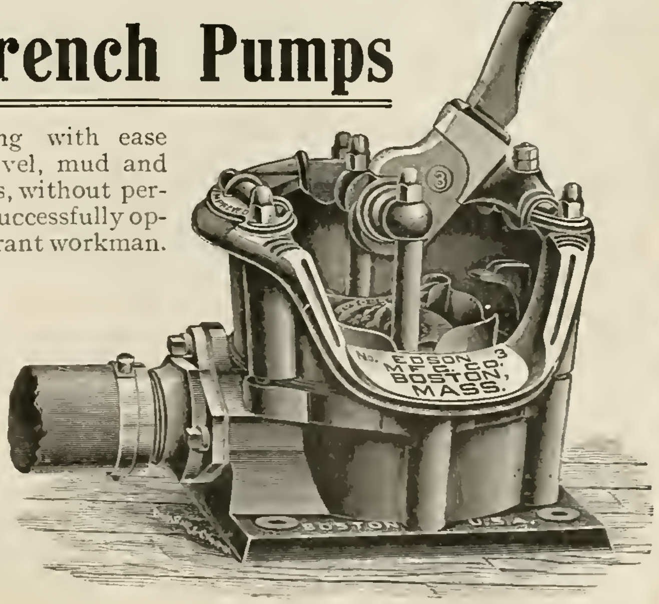
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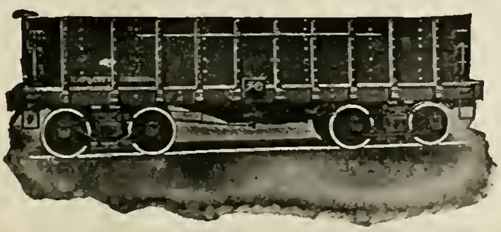

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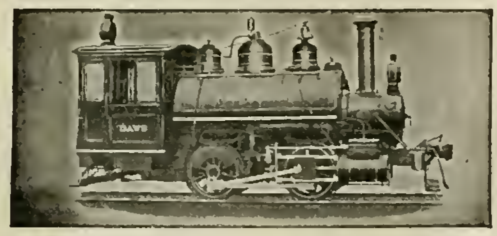

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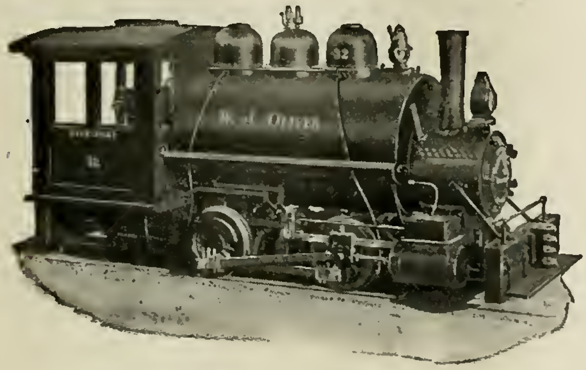

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The Meeting of Cement Users and Manufacturers at the Chicago Cement Show.

The Cement Show held in Chicago, Ill., last week by the associated manufacturers and dealers supporting the Cement Products Exhibition Co. was a pronounced success as an exhibition of cement products and of machinery and tools for the manufacture and working of these products. Approximately a hundred firms were represented by exhibits, which varied in character from books and pamphlets on the properties, manufacture and use of cement products to mixing, hoisting and molding machinery of standard size and capacity and in full operation. To round out the value of this practical exhibition there was an interesting and in many respects useful series of papers and discussions on subjects of concern to users and manufacturers. It is possible here to touch upon only a few of the successful features of the show and of the program of the technical proceedings.

The exhibition managers deserve commendation for the variety of the exhibits secured by them. There were block makers' machines and supplies in abundance to be seen, but the exhibition was not a block makers' exhibition entirely, as has so frequently been the case at cement users' conventions of recent years. The reinforced concrete designer, the maker of mixing and conveying machinery, the cement manufacturer and the ornamental concrete worker were all represented and well represented. This variety to the exhibits had the effect of drawing to the show not merely the workers in one line but the professional man as well. Engineers and architects found an opportunity to study, each in his own field, the more intricate problems of structural design in reinforced concrete and of the artistic and structural adaptation of concrete to building work and engineering construction. Besides its natural claim on the engineer and artisan this variety of interest represented by the exhibits had the effect of drawing to the show the householder and building owner—the persons who when all is said are the ones whose cooperation and confidence must be gained to establish cement in the rank, which all its advocates look forward to, of a material of general utility.

At this point it is worthy of note that the two exhibits which were among those most crowded with visitors were that of the Association of Portland Cement Manufacturers, where the original prize plans and perspectives of concrete dwelling houses were attractively exhibited, and the exhibit in which the model of Mr. Edison's cast concrete house was shown. To the warwise man the fact that the most intently studious of these visitors were women augurs well for the prospects of the business of concrete dwelling house construction.

One other of the various interesting features of the exhibition that calls for special notice was the exhibits of ornamental concrete work. The possibilities of concrete ornament are not new or unknown. As long ago as the Columbian Exposition of 1893 some of the makers of German Portland cement exhibited statuary and other sculptural work in molded cement which commanded admiration. Then, in America at least, the conditions were not ripe for the development of this side of the art of cement working. Cement had no general use in construction, it was employed only to lay up stone masonry or in mass work for foundations, bridges, piers and similar structures. To-day the field for ornamental work in concrete is wide and is becoming fruitful in work done. Those visitors to the show who were so fortunate as to witness the views of concrete ornamental structures exhibited and explained by Mr. Linn White, engineer for the Chicago South Park System, need no proof of this last statement. The things that have been done in an architectural and artistic way with concrete by the Chicago park commissioners can be done elsewhere if the skill and care are taken to do them. Moreover these things are being done elsewhere, and the exhibits of ornamental concrete on the floor of the exhibition hall show that they can be done anywhere.

Turning now to the technical proceedings that formed a part of the Cement Show, it is essential first to draw a distinction between the papers and proceedings of the Northwestern Cement Products Association whose annual convention was held at the same place and same time as the exhibition, and the papers and lectures arranged by the exhibition officials. The Northwestern Cement Products Association is a technical organization with no "business" to foster and exploit. The Cement Show was on the other hand a purely business proposition and naturally and properly its proceedings in the lecture room as well as its exhibits in the hall were designed to promote sales of materials and machinery. This is not said in derrogation at all, but to make it clear to those who read the various papers as they are published hereafter in the technical press that a distinction existed between their sources and purposes.

It may have been too much to expect under the circumstances that the proceedings of even the technical organization should be entirely free of "trade talk." At any rate "trade talk" crept into some of the papers and lectures that had no business to be there. The point of this is not that any great damage was done to the judgematical listener, but that it reflected on the position of the association as an unbiassed professional organization.

While trade talk has no place in the papers or proceedings of a technical organization, it has a value that the technical man cannot afford to neglect. Labled clearly for what it is the talk of the man in the trade, provided that the man knows his specialty, can be of value. This fact was clearly demonstrated in that portion of the program of lectures and papers worked up by the Cement Show officials. The men who talked told mostly of their own particular materials or methods and they spoke as prejudiced witnesses, but they gave many hints and wrinkles to the practical cement worker that were of value. It is a mistake to assume a lofty attitude of exclusiveness in regard to what the man in the trade has to tell. The cement worker and the worker in any other field of engineering employs, and must employ the products and appliances of the men in the trade. This being the case, he should know how to employ them in the best possible way. The man in the trade, if he knows his business, can tell him this way and can, with advantage to the user, be encouraged to do so.

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Concrete and Reinforced Concrete Section

Note: This Section is devoted to methods and costs of constructing concrete and reinforced concrete structures. It will cover the selection, testing and proportioning of concrete materials; laboratory tests of concrete; concrete mixing, transportation and placing; fabrication and placing of reinforcement, and form construction and erection. It will also contain articles on new and interesting developments in the design of reinforced concrete.

Tests of Reinforced Concrete Beams Showing Effects of Quality of Concrete, Method of Loading and Repetitive Loading.[*]

BY ARTHUR N. TALBOT.[†]

Effect of quality of concrete, effect of method of loading, effect of repetitive loading, and diagonal tension failures were among the topics considered. The beams were of the standard width and depth adopted by the Joint Committee on Concrete and Reinforced Concrete, but in the investigation of resistance to diagonal tension failure the length was varied and shortened to ensure this form of failure. (The record of diagonal tension tests is omitted.—Editors.) Plain round rods of mild steel were generally used for reinforcement, but a deformed bar was used in some of the beams. The concrete was varied in quality both in the richness of the mixture and in the conditions of fabrication.

Materials for the tests on "Effect of Method of Loading" and "Effect of Quality of Concrete" were furnished by the Joint Committee on Concrete and Reinforced Concrete through Mr. Richard L. Humphrey, chairman of the Committee on Tests. Materials for the tests on "Effect of Repetition of Load" and "Diagonal Tension Failure" were furnished by the Engineering Experiment Station. The terms "Joint Committee tests" and "Experiment Station tests" will be used to designate this difference of work and materials.

Stone.—The stone for the Joint Committee tests was a good quality of limestone from Kankakee, Ill., ordered screened through a 1-in. screen and over a ¼-in. screen. It contained from 45 per cent to 50 per cent voids and weighed 85 lb. per cu. ft. loose. The stone for the Experiment Station tests was also a Kankakee limestone somewhat softer than the other, screened as above, and contained 50 per cent to 54 per cent voids. It was somewhat finer than the Joint Committee stone. In the determination of the voids in both stone and sand, the material was poured slowly into the water so that the voids became filled with water and no air was caught.

Sand.—The sand used was the same for all tests. It came from near the Wabash river at Attica, Ind. It was of good quality, well graded, and fairly clean. It weighed 115 lbs. per cu. ft. loose, and contained 28 per cent voids.

Cement.—The cement furnished by the Joint Committee was made up of a mixture of five standard American portland cements, selected and mixed by the manufacturers, and was of excellent quality. The cement furnished by the Experiment Station was Chicago AA portland, purchased in the open market of a local dealer.

Concrete.—Men accustomed to making concrete mixed the materials and made the best beams. Care was taken in measuring, mixing, and tamping, to secure as uniform a concrete as possible. All materials were measured by loose volume. The mixing was done with shovels by hand. The sand and cement were first mixed dry. The stone was then added and the mass mixed until uniform in appearance. Water was added in such proportion as to give a slightly wet concrete.

Steel.—The longitudinal reinforcement consisted generally of ½-in. or ¾-in. mild steel plain round rods. In a few beams ½-in. high steel Johnson corrugated bars were used. The plain round bars had an average yield point of 40 500 lbs. per sq. in. and an ultimate strength of 60,000 lbs. per sq. in. The corrugated bars developed an average yield point 57,300 lbs. per sq. in. with an ultimate strength of 87,400 lbs. per sq. in. In general, the yield points of the various bars in one beam varied less than 3 per cent from one another.

Test Beams.—In all of the tests herein discussed the cross-section of the beams was 8 in. x 11 ins., the center of the steel being placed 10 ins. below the top surface except in some cases where the ends of the bars were bent up. In the tests on "Diagonal Tension Failure" the test span varied from 6 ft. to 12 ft. In all the other series of tests a 12-ft. span was used. Unless otherwise specified the reinforcing bars were straight and were placed horizontally throughout the beam. In the beams marked "Bars bent up" the bars were bent up at a point about 3 in. outside the load points and passed diagonally either in a straight line or in a slightly curved line to a point within 2 ins. or 3 ins. of the top of the beam near its ends. In several beams stirrups of ½-in. plain round bars were used. These stirrups were placed 12 in. apart longitudinally throughout the outer thirds of the span length, beginning at the load points. They were U-shaped and passed under all the reinforcing bars and extended nearly to the top of the beam. The stirrups were left very close to the sides of the beam.

Making of the Beams.—The beams were made directly on the concrete floor of the laboratory, a strip of building paper being laid beneath the forms. Several proportions of concrete were used, varying from 1-2-4 to 1-5-10 by loose volume. A number of the first beams were made of 1-3-6 mixture, and the later ones of 1-3-5½, as it was thought that the voids in the stone were not properly filled in the 1-3-6 mixture. The forms, which were of the ordinary wooden knock-down type, were removed four days after making the beams and the beams were not moved in any way for 14 days. Generally the stone for the concrete was dampened and the concrete well mixed and wet enough to secure proper hardening. The making of the beams was skillfully done.

Storage.—The beams were stored in a room the temperature of which was from 60° F. to 70° F. They were tested at the age of about 60 days.

Method of Testing.—The usual method of testing was by loads applied at the one-third points. The beams were all tested in the 200,000-lb. Olsen testing machine, and in all cases except the tests on "Effect of Method of Loading," were loaded at the one-third points. The supports of the beam allowed longitudinal movement, the bottom of the rocker being an arc of 12-ins. radius, and the top, on which cast-iron blocks rested, having a radius of 1½ ins. Turned steel rollers, 2 ins. in diameter, were used for applying the load at the third points. The blocks at the supports and load points were bedded in plaster of paris which was allowed to harden under the weight of the beam and the apparatus used in loading before the load was applied.

Effect of Quality of Concrete.—In this series, tests were made on beams made of three grades of concrete,—1-2-4, 1-3-5½, and 1-5-10 mixtures. The purpose of this series was to determine the effect of quality of concrete upon the strength of the beam and upon the manner of failure. The beams were planned to give a variety of manners of failure,—tension in the steel, compression in the concrete, and diagonal tension in the concrete. Table I gives the results of this series. No attempt is made to calculate the diagonal tensile stresses developed, but the ability to resist diagonal tension will be compared by means of the vertical shearing stresses developed. The load was applied at the one-third points of the beams. From the tables it will be noted that the manner of failure for beams of these proportions depends upon the richness of the concrete. Counting the effect of the weight of the beam and loading apparatus, it is seen that all the beams made with 1-2-4 concrete failed by tension in the steel at calculated stresses somewhat above the elastic limit of the steel.

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[*] Extracted from Bulletin 14, University of Illinois Engineering Experiment Station, Urbana, Ill.

[†] Professor of Municipal and Sanitary Engineering and in charge of Theoretical and Applied Mechanics, University of Illinois, Urbana, Ill.

Of the test beams of 1-3-5½ concrete all but two failed by tension in the steel. The calculated stresses in the steel, when allowance is made for the weight of the beam, are slightly above the elastic limit of the steel. The two not failing by tension in the steel, when compared by the stresses computed either from the bending moment or the observed deformations, gave stresses in the steel not much lower than the average of the remainder of the series. Both of these beams, therefore, had hardly reached the load which would have been followed by failure by tension in the steel. Beam No. 68 failed by diagonal tension at a calculated vertical shearing stress of 115 lb. per sq. in. No. 70 failed by compression of the concrete. The compression diagram shows that the concrete in this beam lacked stiffness, the amount of deformation being more than for the average beam but not much more than that of No. 68, its companion beam, as is seen from the load-deformation diagrams. And yet this beam of 1-3-5½ concrete and 1.65 per cent reinforcement carried a load nearly to the elastic limit of the steel reinforcement.

Table I.—Effect of Quality of Concrete. Span 12 ft. Loaded at One-third Points.

Beam No.	Maximum load, lb.	k	Per cent reinforcement.	Stress in steel, lb. per sq. in.	Vertical shearing stress $v = \frac{V}{bd'}$ lb. per sq. in.	Manner of failure.
			1-2-4 Concrete.			
57	11730	.43	1.15	39800	96	Tension.
59	12000	.53	1.10	44000	97	Tension.
61	10960	.47	1.10	39700	90	Tension.
69*	16000	.57	1.65	39000	129	Tension.
			1-3-5½ Concrete.			
58	9860	.52	1.10	36900	82	Tension.
60	10360	.57	1.10	39400	85	Tension.
64	9850	.55	1.10	37300	82	Tension.
65	10000	.54	1.10	37600	83	Tension.
68*	14220	.57	1.65	35000	115	Diagonal Tension. [crete].
70*	13710	.69	1.65	35800	112	Compression (poor con-
72*	10270	.47	1.10	37400	85	Tension.
73*	9900	.52	1.10	37000	82	Tension.
			1-5-10 Concrete.			
62	8850	.60	1.10	34600	74	Diagonal Tension.
63	7360	.48	1.10	28100	63	Diagonal Tension.
66†	8000	.63	1.25	29400	69	Diagonal Tension.
67†	7850	.57	1.25	27100	68	Diagonal Tension.
71*	7600	.59	1.65	20200	67	Diagonal Tension.

* Stirrups.
† Reinforced with corrugated bars.

All the beams made with 1-5-10 concrete failed by diagonal tension at loads which show a rather narrow range regardless of the amount or method of reinforcement. The vertical shearing unit-stress developed averaged 68 lb. per sq. in. As the beams failed by diagonal tension at loads much smaller than those at which failure by compression in the concrete may be expected, there is nothing in these tests upon which to base the limit of the concrete or the amount of reinforcement at which the compressive strength of the concrete and the tensile strength of the steel may be considered to be balanced.

A comparison of beams having 1.1 per cent reinforcement which failed by tension in the steel shows that the 1-2-4 beams carried greater loads than the 1-3-5½ beams, the additional load amounting to 10 per cent or 15 per cent. This increase of load probably is due to the fact that the greater strength of the richer concrete allows the steel to be stretched a greater distance beyond the elastic limit before developing the full compressive strength of the concrete and also that the moment arm of the couple formed by the compressive stresses is somewhat greater with the richer concrete. The added strength of the richer concrete in preventing failure by diagonal tension is apparent. The arrangement of stirrups used was not well planned and their presence seemed not to add to the strength of the beams, although in Beams No. 68 and 71 it might have been expected that well designed stirrups would prevent failure by diagonal tension.

Table II.—Effect of Method of Loading.
Reinforcement .98%; Concrete 1-3-5½; Span 12 ft; all failed by tension in the steel.

Beam No.	Method of loading.	Maximum applied load, lb	k	Stress in steel lb. per sq. in.
50	Center.	7400	.45	45200
52	Center.	7650	.38	45400
53	2 points 1½ ft. apart.	7900	.45	42500
54	2 points 1½ ft. apart.	8250	42	43500
55	2 points 3 ft. apart.	8900	.44	40700
56	2 points 3 ft. apart.	9610	.51	45000
40	One-third points.	10000	.46	41000
42	One-third points.	9420	.47	39000
45	2 points 7½ ft. apart.	17300	.50	40100
51	2 points 7½ ft. apart.	18000	.45	40700
43	8 points 18 in. apart.	14000	.44	42100
44	8 points 18 in. apart.	15000	.41	44300

Effect of Method of Loading.—It was the purpose of this series to determine the effect of the method of loading upon the resisting moment developed in the beam. With this in view, the beams were so proportioned that failure by tension in the steel was expected in all cases. Six methods of loading were used in the tests of this series: (1) load applied at center of the span only; (2) load applied at two points 1½ ft. apart; (3) load applied at two points 3 ft. apart; (4) load applied at the one-third points; (5) load applied at two points 7½ ft. apart; (6) load applied at eight points (to approximate a uniform load).

Table II gives the results of these tests, together with the calculated stresses in the steel. All beams failed by tension in the steel, as was clearly shown by the load-deformation diagrams. If the effect of the weight of the beam and loading apparatus is included, it will be seen that the calculated stresses in the steel all lie above the elastic limit. A comparison of the resisting moments of the beams may be made by comparing the calculated stresses in the steel, given in Table II, since the tests of the steel used in these beams show that there was little variation in the yield point of the test pieces. It will be noted that the highest stress developed was in beams having the loading at the middle, and that when the two loads were close to the middle the results were not much lower. For the other methods of loading the variation in stress developed was not large, no greater than may be expected with the difference in the materials and fabrication in such beams, though the method in which the load was applied at eight points gave a somewhat higher resisting moment. These tests go to show the general applicability of the ordinary beam theory to simple beams without end restraint or horizontal restraint for any of the usual methods of loading, with the exception of center loading, provided, of course, that the proportions of the beam are such that the method of failure is by tension in the steel. It will be seen that the beams loaded at the middle give about 10 per cent greater resistance than the more usual methods of loading. This excess is not so great as has been found in beams having a high percentage of reinforcement. With high reinforcement the resulting moment developed is considerably greater than for loading at the one-third points. Evidently under such conditions loading at the middle gives a distribution of stresses at sections near the center of the beam which is different from that assumed in the ordinary theory of flexure.

The load deformation curves have the same general characteristics in all of the beams. The position of the neutral axis, as determined by the method used, is nearly the same for the several methods of loading, the variation being as little as may be expected in tests of this character and no characteristic difference being noticeable in any method of loading. Of course, with the load applied in the middle the deformations were taken over so great a gauged length that a discrepancy in the distribution of stress at a section at the middle had little effect on the values found.

Effect of Repetitive Loading.—Tests were made on six beams to determine the effect of repeatedly applying and releasing the load on the beam, from 24 to 30 applications of a single load being made. Three mixtures of concrete were used, thus permitting a study of the effect of quality of concrete. All beams were reinforced with 1 per cent of steel. The load applied was 5,000 lb. in three beams, and 6,000 lb. in the other three. These loads were from 50 per cent to 85 per cent of the maximum load carried by the beam when the load was finally increased to the point of failure. The deflection at the midpoint of the span was measured, as were the deformations at the top and bottom for a gauged length along the middle of the beam, though the latter measurements were not entirely satisfactory. Table III and Table IV give results of these tests.

These tests throw light upon the phenomena of repetitive loading and show the need of further investigation in this direction, but they are not at all conclusive. The manner of failure in general is the same as may be expected with beams of the same reinforcement and same quality of concrete loaded progressively to final failure. Whether the maximum load carried in the case of the repetitive loading is less than would have been the case with progressive loading is not known. There are some indications that the maximum load was less than it would have been without repetition.

The increase in the deflection of the beams with repetition of the load is quite apparent. Much of this increase is due to the increased amount of shortening of the concrete in the compression side of the beam with repetition. A part is due to the breaking of the concrete in tension and the transferring of the tensile stress once taken by the concrete to the steel itself. This accounts for part of the set in the deflection curve upon the release of the load. Part of the set must be due to the concrete in the lower fiber not meshing, so to speak, when the load is released after numerous fine cracks have appeared. For this reason some tension remains in the steel reinforcement after the load is taken off. It seems evident that upon the removal of the load the beam does not regain its original shape and a section which was plane before bending will not be plane upon release of the load. The plastic nature of the concrete on the compression side gives a set, and the concrete on the tension side is unable to return to its original position; the two act together to cause the fibers not to return to the original plane section. These several causes operate together to produce the permanent deflection or set.

The load applied in the cases of the leaner concretes was 67 per cent to 85 per cent of the maximum load which the beam finally held. In the case of the better concrete, the repeated load was 50 per cent to 60 per cent of the maximum load. The effect of the quality of the concrete is seen in the manner of failure.

TABLE III.—EFFECT OF REPETITIVE LOADING.
Span 12 ft; Loaded at One-third Points.

Beam No.	Mixture.	Age, days.	Per cent reinforcement.	Repeated load, lb.	No. of applications.	Failed at lb.	Manner of failure
28	1-2-4	70	0.98	6000	26	9900	Tension.
31	1-2-4	78	0 98	6000	25	9400	Tension.
29	1-3-5½	71	0 98	5000	30	10000	Diagonal tension.
32	1-3-5½	79	0 98	6000	24	9800	Tension.
30	1-4-7½	71	0 98	5000	30	5900	Diagonal tension.
35	1-4-7½	75	0.98	5000	30	7500	Compression.

This topic is one of such importance that it merits fuller investigation. The few tests which have been made indicate that the deflection and the deformations increase with repetition. It seems quite probable that the breaking load under a number of repetitions will be smaller than under a single load. It seems to be true also that the amount of reinforcement for which the elastic tensile strength of the steel used for reinforcement may be considered to balance the compressive strength in the concrete of the beam (which the writer calls "the balanced reinforcement") should be taken at a lower percentage in beams subjected to a repetition of load than is found necessary in the case of beams tested by means of a gradually applied load.

TABLE IV.—DEFLECTIONS UNDER REPETITIVE LOADING.

Beam No.	Mixture.	Center deflection in inches for 5000-lb. load						
		Application.						
		1st	5th	10th	15th	20th	25th	30th
28	1-2-4	0.25	0.33	0.34	0.36	0.37	0.38	....
31	1-2-4	0.25	0.33	0.35	0.35	0.36	0.37	....
29	1-3-5½	0 15	0 25	0 25	0 25	0 25	0.26	0.25
32	1-3-5½	0.24	0 31	0.33	0.34	0.34	......	....
30	1-4-7½	0 40	0.49	0.54	0 57	0 60	0.62	0.65
35	1-4-7½	0.31	0.38	0.40	0.41	0.41	0.41	0.42

The term "balanced reinforcement" referred to above is a convenient term for general use. It should be taken to mean that amount of reinforcement for which the allowable stress in the steel and the allowable stress in the concrete both exist at the same time. The factors of safety for the two materials will not be the same. The determination of the balanced reinforcement for given conditions of materials, fabrication, and use is a matter involving calculation and experimentation, but in any event the judgment of the designer must enter into the choice of the amount.

Summary.—The following summary of parts of the foregoing discussion is given:

(1.) For beams proportioned to give failure by tension in the steel reinforcement (i. e., when neither compression of concrete nor diagonal tension causes failure), those made with the richer concrete carried higher loads. The beams with 1-2-4 concrete carried loads greater by, say, 10 per cent, than those with 1-3-5½ concrete.

(2.) In beams which failed by tension in the steel, the resisting moment developed was found to be about the same for loads applied at two points more or less far apart and at eight points (approaching a uniform load), thus confirming the general applicability of the ordinary beam theory to simple beams without end restraint or horizontal restraint for any of the ordinary methods of loading. For center loading the resisting moment developed ran 10 per cent higher and in former tests even greater. This excess indicates a different distribution of stresses for center loading from that assumed in the ordinary beam theory.

(3.) The tests with repetitive loading are not conclusive and show the need of further investigation in this direction. The manner of failure in general was the same as may be expected with beams of the same reinforcement and same quality of concrete loaded progressively to final failure. Whether the maximum load carried in the case of this repetitive loading is less than would have been the case with progressive loading is not known, but there are some indications that the maximum load was less than it would have been without repetition. The increase in the deflections of the beam with repetition of the load was marked, and the set in the beam was considerable. It should be remembered that the repetitive load was a considerable proportion of the maximum load finally applied and much higher than ordinary working loads. It seems evident that the amount of reinforcement for which the elastic tensile strength of the steel may be considered to balance the compressive strength of the concrete (conveniently called the "balanced reinforcement"), should be taken at a lower percentage in beams subjected to a repetition of load than is found necessary in the case of beams tested by means of a gradually applied load, and that for the ordinary conditions of fabrication and use the "balanced reinforcement" selected should be much less than that determined by test beams.

(4.) The manner of failure depends not only upon the relative dimensions of depth and length of beam and the amount of reinforcement, but also upon the richness and strength of the concrete.

The Northwestern Cement Products Association Annual Convention.

This association held its fifth annual meeting in Chicago on Dec. 18 and 19 in connection with the cement show referred to in another column. The general character of the proceedings has been referred to in our editorial columns and such portions of the papers as were of practical value will be given in succeeding issues as space permits.

The report of the secretary of the association showed the following as to its finances:

Total to bills receivable:	
Sale of space	$ 940.00
Commercial Club donation	75.00
Program and sundries	295.82
Membership	354.00
	$1,664.82
By spaces and programs not collected	$ 50.00
By amounts paid to treasurer	1,614 82
	$1,664.82

The election of officers resulted as follows: President, Martin T. Roche, St. Paul; vice-presidents, H. E. Murphy, Manitowoc, Wis.; O. U. Miracle, Minneapolis; C. A. P. Turner, Minneapolis; A. H. Laughlin, Lisbon, N. D.; Col. Lee Stover, Watertown, S. D.; secretary, J. Van Dorn, Minneapolis; and treasurer, J. M. Hazen, Minneapolis.

The Mechanical Division of the Isthmian Canal Construction Organization reports the following average labor cost for erecting new equipment in the Isthmus, according to the Canal Record. The labor cost is labor actually applied, including foreman's supervision:

Locomotives.	
200-class..19 by 24 inches Mogul..	$590.35
300-class..19 by 24 inches Mogul..	790.30
600-class..20 by 26 inches Mogul..	820.00
Steam Shovels.	
45-ton	490.00
70-ton	650.00
95-ton	770.00
Cars.	
Western dump cars 186-10 yards..	40.00
Western dump cars, 12-yard	30.00
40-ton wooden flat cars	77.10
50-ton steel flat cars	82.70
Ingoldsby dump cars, 50-ton automatic	64.90
Goodwin dump cars, 40-ton automatic	67.40

Earth and Rock Section

Note: This section is devoted to methods and costs of excavating earth and rock and building embankments. It will cover the grading of roads and railroads, diking and canal work, dredging, building reservoirs and earth dams, sewer and water pipe trenching, quarrying, etc.

Methods and Cost of Clearing and Grubbing Land.

One of the items of work to be done in grading a railroad is generally the clearing and grubbing of the land. Under some contracts and specifications this work is paid for as one item, under others as two items as clearing and as grubbing, while under other forms of contracts this work is included in that of excavation.

The method of paying for clearing by the acre as one item and grubbing as another item is to be commended. In order to do the excavation all the land must be cleared, but in addition to the area used for the cuts and embankments, the entire width of the right of way must be cleared, and overhanging trees and branches must be cut away. On the other hand there is no need of grubbing the area occupied by the embankments, nor that on the right of way not included in the cuts, hence there should be no reason why this area should be included in the payment. Likewise the method of doing the excavation will very materially effect the cost of the grubbing, while it does not play any part in the cost of clearing.

When steam shovels are used the grubbing cost is small, as this machine will undermine the stumps, causing them to fall into the pit, where they can be loaded onto the cars by means of chains, attached to the dipper teeth. This work retards the progress made by the shovel, but the cost of grubbing is greatly reduced, and a contractor could afford to bid a low price on the grubbing when done with a steam shovel, if it is not lumped in with the clearing or other work.

When grubbing is done in connection with rock excavation, its cost is small as the stumps are shot out with the blasting of the rock, and the only additional expense is to dispose of the stump. This will have to be done by hand and will be work that the contractor will charge for under grubbing.

When grubbing is done for scraper work the stumps and largest roots must be blasted and dug out, and the work is much more expensive than with rock excavation and steam shovel work, although a large railroad plow in loosening the ground will cut and break up many of the roots, so that they do not have to be grubbed.

The grubbing for elevating grader excavation must be done much more thoroughly, than that for scraper work. The stumps and large roots must not only be grubbed, but all the small bush stubs and roots must also be cut out, this is necessary as the grader plow will not cut these roots, as the pull on the plow is a steady one, unlike that of a breaking plow, which can be run in jerks, while the plowman can shake up the plow, which is a considerable help. In grubbing for a grader it is not advisable to blast the stumps as this makes large deep holes, which after rains, become full of water and soft, thus causing the traction engine and grader to mire in these holes. For this reason where there are many stumps of 6 ins. or more in size a stump puller should be used. The stump puller does its work much better than blasting, as it will not only pull up the stump, but also all the large roots and many of the small ones. Nor does it leave as large a hole, as a blast does. Its work is as economical as blasting, and at times is much cheaper. For costs on work done with a stump puller see Engineering-Contracting, Oct. 17, 1906, page 98. The small stubs and roots must all be grubbed by hand. To do efficient work of grubbing for a grader, after the large stumps have been pulled, men should be spaced a few feet apart and the entire area gone over, the men working in rows grubbing up everything that may effect the working of the grader. This makes grader grubbing more expensive than that of any other grubbing for ordinary excavation work.

The job to be described was the clearing and grubbing on nine miles of railroad construction. Most of the line was through cultivated fields, but in 11 places varying in length from 100 to 4,600 ft. there was clearing to be done. In all there were 14¼ acres, of which 1¼ acres were over areas upon which embankments were to be made, while 13 acres were in cuts, hence there was both clearing and grubbing to do. The excavation was to be done by an elevating grader and as stated above the grubbing had to be done more thoroughly than it would have been, if other methods of excavating had been employed.

The first work done was to clear the ground. Most of the brush was burnt, but some of it and the logs were rolled to the edge of the right of way and piled up. The trees, of the size of 6 ins. or more in diameter, numbered about 40 to the acre; but there was a very rank undergrowth of bushes and saplings, the stumps and roots of which all had to be grubbed. The work was done by contract, and the men working upon the job were not experienced woodsmen or axemen, but were such as could be obtained at the labor market centers. Many of them were foreigners. The wages paid to the foreman was $2.50 and to the men $1.50 per ten hour day. A waterboy was paid $1.00 per day. In the clearing gang an average of 12 men were worked, some using axes and other brush hooks. The brush was piled by hand, no forks being used, and the logs, few being more than 3 ft. in diameter, were cut short and rolled by means of hand sticks. Some few were carried by the men with these sticks.

The cost of the clearing was as follows:

Foreman	$ 65.50
Men	386.25
Water boy	19.30
Total cost cleaning	$471.05

The cost per acre, there being as stated 14¼ acres, was:

Foreman	$ 4.59
Men	27.10
Water boy	1.36
Total cost clearing per acre	$33.05

The grubbing was done by a gang of men averaging 15. The wages were the same. Some few of the larger stumps were blasted, and their roots afterwards grubbed. Dynamite, costing 15 cts. per lb., was used for this blasting. No separate record of the stumps that were blasted nor of the explosive used for each was kept, only the total cost of the explosives being kept, and the labor of blasting was included in with the other grubbing. For a detail record of blasting stumps of a similar size see ENGINEERING-CONTRACTING Feb. 27, 1907, page 93. About 6 stumps were blasted to the acre.

The cost of grubbing was as follows:

Foreman	$ 59.00
Men	505.00
Water boy	23.50
Explosives	33.00
Total cost of grubbing	$620.50

The cost per acre, there being but 13 acres to grub, was:

Foreman	$ 4.54
Men	38.84
Water boy	1.81
Explosives	2.54
Total cost grubbing per acre	$47.73

The men used long cutter mattocks and short handled shovels in grubbing the stumps and roots. There is but little doubt that this cost of grubbing could have been reduced by the use of a stump puller, but the contractor did not own one, and thought the job too small to justify purchasing such a machine.

The total cost for clearing and grubbing was as follows:

Foreman	$ 124.50
Men	891.25
Water boy	42.80
Explosives	33.00
Total cleaning and grubbing	$1,091.55

This gives a cost per acre of the following:

Foreman	$ 8.74
Men	62.54
Water boy	3.00
Explosives	33.00
Total clearing and grubbing per acre	$76.60

The tools used for this work cost about $50, but with the exception of the brush hooks, they were all used on other work, hence to charge half their cost to this job would be sufficient. This means a charge for tools of $2 per acre, making a total of $78.60. This work was being done at the same time that grading and other construction was going on, hence the charge to be added for general expense, such as superintendence and office expenses would be small.

This clearing and grubbing was not paid for by the acre, but the work was included with the grading, and the price of excavation covered the clearing and grubbing. There was 90,000 cu. yds. of earth excavation on the 9 miles of road, hence the cost of clearing and grubbing amounted to about 1¼ ct. per cu. yd. of earth. If elevating graders had not been used, the cost with the same forces doing the work, would have been less than 1 ct. per cu. yd.

Another example of clearing and grubbing that may prove of interest is given below. Five acres of woodland was to be cleared and grubbed of all bushes and worthless saplings, vines and briers. The undergrowth was dense. None of the trees were to be cut. The clearing was done by a contractor, but he was paid "force account," that is by the day for his work. The wages paid were the same as in the example just given. The brush, old logs and other debris had to be burnt, and care had to be exercised that none of the trees were injured as the woods was to be made into a park. The cost for clearing was as follows:

Foreman	$36.25
Men	270.30
Water boy	15.00
Total	$321.55

This gives a cost per acre of the following:

Foreman	$ 7.25
Men	54.06
Water boy	3.00
Total	$64.31

This work was done in the fall of the year, and the weather was exceptionally good. The following spring the ground had to be thoroughly grubbed in order to plant grass seed in the woodland. This work was done with mattocks, every inch of the ground being gone over, brier roots, old stubs and all roots of bushes being dug out. There were also a few old stumps that had to be taken out, but the work was mostly the small surface roots of bushes, saplings and briers. After the ground was gone over with mattocks, steel rakes were used to rake out the roots, and put them in piles. Wheelbarrows were then used to haul them away to a waste pile, where they were afterwards burnt, when they had dried sufficiently.

This work had to be well done, or else the grass seed would not make a good sod; that an excellent sod was obtained in one season, was evidence that the work was well done. Company forces did this grubbing, the rates of wages being: Foreman $2.50, for 9 hours, and laborers $1.50 for 9 hours. The cost of the grubbing was:

Foreman	$ 21.00
Men	256.00
Total	$277.50

The cost per acre was as follows:

Foreman	$ 4.20
Men	51.30
Total	$55.50

This gives us a total cost for clearing and grubbing of $119.81 per acre. To this should be added $2.00 per acre for tools.

If this work had been done by contract, it could not have been done better, but there is little doubt, that the cost would have been less.

The New Hydraulic Dredge, "Francis T. Simmons," at Lincoln Park, Chicago, Ill.

The extension of Lincoln Park, Chicago, Ill., work on which is now underway, involves the reclaiming from Lake Michigan of an area approximately 1,500 ft. wide by about a mile long by enclosing it with a stone breakwater and filling in behind it with material taken from the bed of the lake. For much of the distance the breakwater lies in 18 ft. of water and the total volume of fill to be made is about 4,000,000 cu. yds. The breakwater is now partly completed and is made of stone from the spoil-banks of the Chicago Drainage Canal. A fleet of large scows with several powerful tugs are employed to bring the stone from the canal by way of the Chicago River out into the lake and so to the site of the work.

The conditions surrounding the dredging and filling of this work were difficult and peculiar. Not only was the locality in deep water and exposed to the storms of Lake Michigan, which often rise with suddenness and severity, but the soil to be dredged consisted of the tough blue clay which underlies the Chicago area, compacted by the storms of the lake and mixed with more, or less gravel and stones.

To meet these conditions the Park Commissioners had built the hydraulic dredge shown in the accompanying cuts, Figs. 1 and 2. This dredge was put in service in June, 1907.

A brief description of this dredge follows: 'The hull is of steel 148 ft. long, 38 ft. wide, by 10 ft. 6 in. deep. The main pump has 30-in. suction and discharge and the main engines are of the triple expansion marine type of 1,200 I. H. P. There are two double-ended marine boilers 11 ft. 6 in. x 18 ft. long with eight corrugated furnaces. The installation of engine room auxiliaries such as condensing apparatus, pumps, electric light is most complete and well arranged, the engine-room space in fact resembling a small ocean liner. On the upper deck is a pilot-house with large plate-glass windows, where are arranged all the levers which control the operation of the dredge. Here are also pressure and vacuum gauges for all purposes, indicating exactly the work that is being done. The suction pipe is carried by a very strong steel frame and is fitted with a powerful cutter for digging the clay. This cutter is an improved development of a number of earlier machines and has demonstrated its efficiency by being able to handle the heavist clay up to the full capacity of the pump. It is 9 ft. in diameter, and weighs about 9 tons being formed of eight steel blades of peculiar curvature cast in one piece, and having renewable hard steel cutting edges attached. The mechanism for driving and feeding this cutter is of the most powerful description. The secret of success of this dredge is that the excavation of the stiff clay is done by an efficient cutting tool that will not clog and provided with a powerful feed, the main pump being only employed for transportation of the spoil. A capacity rate of 3,000 cu. yds. per hour is said to have been reached frequently in clay, the entire underside of the discharge appearing as continuous slices of blue clay some of the pieces being 4 or 5 ft. long.

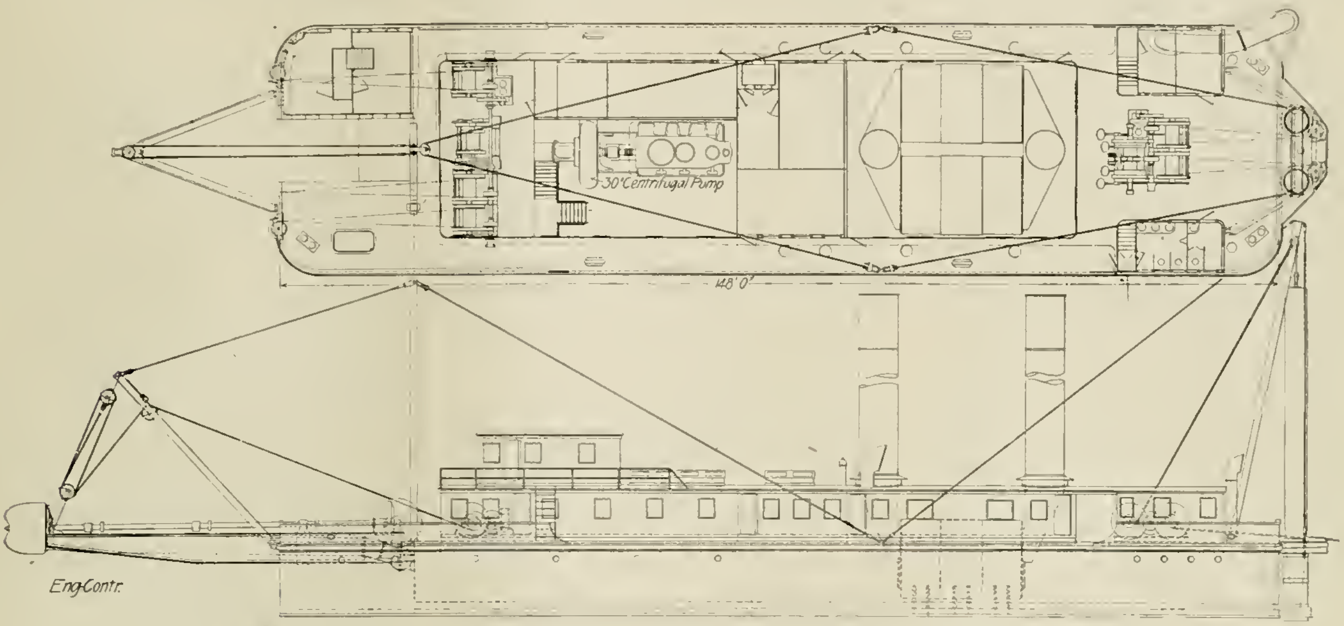

Fig. 1—Plan and Elevation of Hydraulic Dredge for Lincoln Park Improvement, Chicago, Ill.

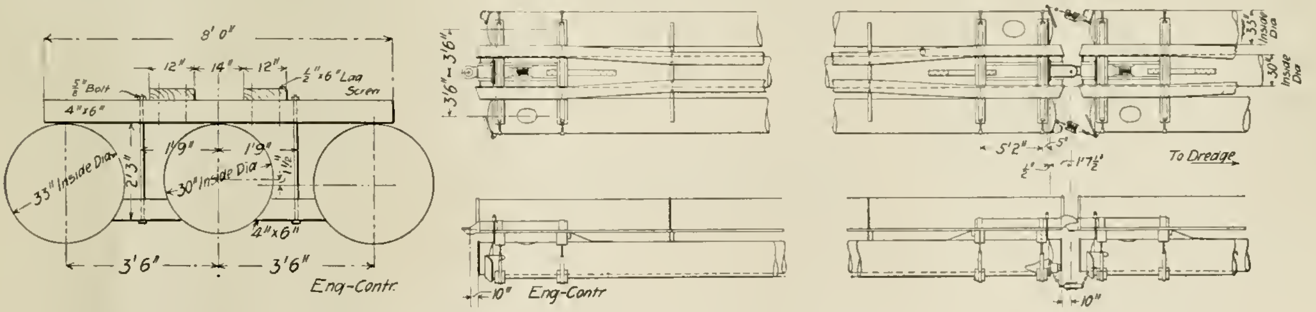

FIG. 2—Details of Floats for Discharge Pipe for Hydraulic Dredge for Lincoln Park Improvement.

One of the most serious problems to be dealt with was that of the floating pipe-line. This is said to be the most seaworthy pipe-line on the lakes and is formed of semi-submerged steel pontoons about 100 ft. long, connected by ball-and-socket joints having spring connections of great strength. Long lengths of pontoon were necessary to give steadiness in waves and a yielding connection was essential to relieve the joints of the great stresses due to surging. The springs are of locomotive draw-bar size and are arranged similarly to railway car draft-rigging. There are also tension and compression springs to control the side deflection of the joint. In wave-action this pipe-line is very satisfactory. A special flange connection is provided at the dredge so that the pipe-line can be instantaneously disconnected from the dredge at any time simply by pulling out a toggle-lever.

On several occasions when it became too rough for the dredge to work owing to the difficulty of discharging over the break-water, the pipe-line was disconnected and towed to harbor by a tug through a rough sea which broke over both tug and pipes continuously with no harm whatever to the pipe-line. These occasions, however, are relatively rare and the operation of the dredge has proved not only that the clay of the bed of Lake Michigan can be dredged by this method, but also that the seaworthiness of both dredge and pipe-line is sufficient to reduce the delays on account of weather to a comparatively small amount.

The dredge was designed by Mr. A. W. Robinson, M. Am. Soc. C. E., and was built by the Atlantic Equipment Co., of 111 Broadway, New York. In a future issue we expect to be able to give some records of the work of this dredge.

The Signal Office of the U. S. War Department has sent out specifications and will receive bids until Jan. 15 for the construction of a dirigible balloon for the use of the army. The balloon is to be of silk inflated with hydrogen, capable of carrying two men, and of making a speed of twenty miles per hour in still air. It must make an endurance flight of two hours at an average speed of 70 per cent of the trial requirements, and must maintain its equilibrium without change of position by the aeronaut.

Unclassified and General Articles

Note: This section is devoted to methods and cost articles on construction work not properly coming under any of the preceding classifications.

Methods and Costs; Some Old, Some New.

Destroying Vegetation in Track.—On a 35 mile section of dirt track vegetation was destroyed at a cost of $35 per mile per season, according to a report read before the 1907 convention of the Roadmasters and Maintenance of Way Association. In the spring when the weeds and grass were high enough to cause trouble they were cut with shovels from the ends of the ties and between the ties from the outside; inside the rails the vegetation was cut only as far as the shovel would go by running it under the rails between the ties. This cutting can be done for about $7.50 per mile, and the operation was repeated every six weeks until about Oct. 1. when the cutting is done inside and outside at a cost of about $12.50 per mile. This makes the cost as follows:

Three cuttings at $7.50	$22.50
Final clean up	12.50
Total per mile per year	$35.00

This, the report states, will keep the grass out of the way of trains but will not keep the track clean, as this provides for a thorough clean up once a year. To do this work a light steel shovel is used. The above work is done by section gangs, the laborers receiving $1.25 per 10-hour day, and the foremen about $2.25 per day.

Steam Shovel "Dredge."—A steam shovel mounted upon a barge was used in securing gravel from the beds of streams for ballasting purposes. The gravel was obtained from streams which contained very little water during nine months of the year. The barge used cost about $1,000 and had a deck 20x50 ft. Upon this was securely mounted on a track a steam shovel weighing 78,000 lbs. and having a dipper capacity of 1½ cu. yds. The barge drew 2 1-3 ft. of water. In excavating the gravel, the steam shovel was run forward on its track, the bow of the barge sinking and practically resting on the bottom, although for safety four 10x10-in. spuds at the corners of the barge were used to hold the barge stationary. The excavated gravel was loaded into cars on a temporary track alongside the bank. When the gravel within reach of the dipper had been exhausted, the shovel was moved back on the track, the bow of the barge rising. The barge was then advanced and again secured by spuds. The cost of securing the gravel was about 4 cts. per cubic yard.

Moving Pier Back to Place.—A masonry pier built in about 12 ft. of water on a box-cassion sunk upon piles and riprapped was moved out of position about 1 ft. at one end by an ice jam. The pier with its platform weighed about 500 tons. To get it back in place a crib 20x13 ft. was sunk alongside the pier and loaded with stones; a line of 9 piles was also driven outside of the crib. Four 50-ton hydraulic jacks were then placed between the crib and the pier and the latter pushed back into place without causing a crack in the masonry.

Cost of Ballasting Old Track.—The following matter has been taken from the report of a committee read before the 1907 convention of the Roadmasters and Maintenance of Way Association: On a northern division of the Chicago & Northwestern Ry. the cost of ballasting one mile of track with gravel was $1,020. figured on the basis that 3,400 cu. yds. of material would be used per mile. The gravel was unscreened and unwashed and was used just as it came from the pit. The gravel was placed for a 12-in. raise with standard gravel roadbed on the top of 11.6-in. slope, 1½ to 1 on the bottom and 16 ft. from bottom ballast line to ballast line. The itemized cost per cubic yard was as follows:

Cost of gravel loaded on cars at pit	$ .07
Hauling and unloading, 50-mile haul	.10 2-3
Ballasting	.12 1-3
Total	$ .30

On a division of the Lake Shore & Michigan Southern Ry. for the year 1906 the cost of ballasting with gravel was as follows:

	Per cu. yd.
Gravel, washing and loading	$ .18
Hauling	.07
Cost of digging out old ballast	.15
Cost of unloading and placing in track	.15
Total	$ .55

For crushed limestone ¾ to 1½ in. in size the cost was as follows:

	Per cu. yd.
Cost of stone	$ .535
Digging out old ballast	.15
Hauling, unloading and placing in track	.40
Total	$1.085

For ballasting with crushed stone on a division of the Atchison, Topeka & Santa Fe Ry. the cost was as follows

	Per cu yd.
Crushed stone at crusher, loaded on cars	$ .615
Haul, 50 miles	.055
Labor, Mexican, inserting	.33
Total	$1 00

For a 12-in. raise 3,400 cu. yds. of ballast are used per mile, making the cost $3,400. The present standard on this road requires the ballast to be dressed level with the top of the ties for the full length of the tie and 6 ins. beyond the ends of ties, making the top widths of the ballast 9 ft. and giving a slope of 1½ to 1; this gives a roadbed 16 ft. wide from ballast line on one side to ballast line on the other side, with a 12-in. raise.

Stopping Water Flow Through 8-in. Hole.—Owing to the breakage of a pump located in a pump well it became necessary to stop the flow of water from an 8-in. hole drilled from the bottom of the pump well to a tunnel connected with another well. This was done in the following manner: A bag, shaped like a baloon, about 3 ft. in diameter and 6 ft. long, was made of six plys of bedticking, roughly quilted into squares. This bag was then soaked in linseed oil, and a quantity of rye flour inserted and well shaken around. A 1-in. pipe terminating in a sleeve was inserted into the mouth of the bag, which was then securely wired to the pipe. A stout ring was attached to the bottom of the bag and to this was wired a half pig of iron by a ring bolt fastened to its end. The bag was then wrapped tightly with twine until it had a cylindrical shape, and was lowered into the drill hole in the pumping well by means of sections of pipe until the weight struck the bottom of the tunnel below. It was believed that one-half of the bag entered the tunnel, the other half remaining in the drill hole. The 1-in. pipe was then attached to a service main and the bag slowly distended under a pressure of 50 lbs. per square inch. The upper part of the bag swelled out and accommodated itself to the irregularities of the drill hole, and the lower part swelled out into a bulb shape, thus stopping the flow of water through the drill hole. The pumping well was then emptied, the bag being held in place by an interior water pressure of about 10 lbs. per square inch more than the exterior water pressure.

The number of vessels built in Germany in 1906 was 760, of 398,151 registered tons, against 646 of 310,771 registered tons in 1905.

Some Costs to Electric Railway Companies of Street Cleaning and Oiling and Sprinkling Roadbed.[*]

On city tracks the care of the roadway, besides the keeping of rails, switches and curves in good order, includes more or less of cleaning, sprinkling and snow removal. In order to determine the practice of different companies and for a guide for future operation, inquiries on these subjects were sent to 50 leading companies. From their reports, the following notes have been prepared:

Street Cleaning.—In the matter of cleaning the space occupied by tracks on paved streets, the general practice is that the municipality bears the entire expense, as the theory is that the cars do not bring dirt onto the street and the cleaning of the entire paved roadway would have to be done and the expense borne by the city if there were no tracks.

The fact of the tracks being in the street does not entail additional expense on the city. This view has been upheld in the courts, and it appears that refuse and things left on the streets by pedestrians, teams and by storekeepers, who often dispose of litter by throwing or sweeping it into the roadway, should be taken care of by the city authorities. Inquiries on this subject were made of 50 companies in all parts of the country, and 46 replying and operating 8,469 miles of track with a tributary population of 13,241,000, it appears that 41 operating 6,706 miles of track, pay no part of the street cleaning expense.

In a few cities the railways bear a part of the street cleaning expense, this being done either voluntarily or by charter requirement. In these cases, it should be considered as a contribution or a part of the amounts paid by way of taxation.

The following are among the prominent companies which assist the cities in this matter: Chicago Union Traction Co., Chicago City Railway Co. and South Chicago City Railway Co. cost $123.60 per mile for cleaning and sprinkling in 1906.

Columbus, O., on 79 miles of single track within city limits partly on unpaved streets, cost for cleaning and sprinkling was $13,000 in 1906; cost per mile of track, $164.55.

The Twin City Rapid Transit Co. pays for sweeping its track allowance in St. Paul and Minneapolis; 86.12 miles of single track in 1906 cost $23,475.55; cost per mile, $272.56.

Street Sprinkling.—In the large majority of towns the street sprinkling is taken care of by the municipal authorities without reference to the street railways, no part of the expense being paid by the companies. Returns from 24 companies, operating 4,768 miles and having a tributary population of 10,156,000, show this condition:

Companies operating 3,356 miles sprinkle tracks only with tank cars; of these the practice is so mixed that it is difficult to know how much mileage is sprinkled. In general it appears that the more important streets are the only ones sprinkled. This is done under requirement of state law or city ordinances. The cities are required to furnish water without charge, though in some places the company is obliged to pay for the water; in one case, 6 cts. per mile of track.

The business of sprinkling the whole of the roadway from tank cars has been developed to quite an extent; one outside company owning cars makes contracts with cities for sprinkling the roadways and has 250 miles of streets covered. The railway companies operate the cars for a price per car-mile. The authorities of the cities report that the service is very satisfactory. The railway officials report that this plan gives good results, and while the returns are small, the conditions on the whole, are satisfactory.

A number of cities pay the railway companies directly for this same kind of service. Prices received by the company for this work vary from 7 cts. to 17 cts. per car-mile, 10 cts. being about an average. The cost to the property owners per season is about 10 cts. per foot of street or 5 cts. per front foot.

The tank cars used are of a variety of types, from the plain rectangular box to the cylindrical sheet iron tanks, operated either directly by gravity, or as pneumatic sprinklers, having the tank under air pressure. The capacity is from 2,500 gallons to 6,000 gallons.

Four thousand gallons will sprinkle some six miles of tracks or three miles of entire roadway. Any statements of this kind are rather indefinite depending upon so many conditions. A better idea of the work done is to say that in actual practice one car making four trips per day will care for eight miles of street.

Oil Sprinkling.—The use of oil for laying dust on some streets and for the roadbeds of railways has been extensively advocated. It has been tried by a number of roads. Some consider its use satisfactory, but the greater number have not put it into extensive use. The heavy asphalt oils of California appear to give the best results, while in the Central and Eastern States a so-called "Roadbed" oil prepared by the Standard Oil Company has been used more or less experimentally for ten or twelve years.

Among the steam roads that have used oil are: The Boston & Maine, Boston & Albany, Central Railroad of New Jersey, Long Island Railroad, Delaware & Hudson, Santa Fe, Chicago, Burlington & Quincy, Oregon Short Line, Chicago & Alton and the Southern Pacific; the latter the most extensively, having used it for five or six years on about 900 miles of road.

In practice the roadbed is sprinkled with about 2,000 gallons per mile for the first application. After the first dressing, the quantity may be lessened to 600 or 1,000 gallons per mile annually, though some parties claim that two applications annually are needed. The sprinkling appliances used and the process are claimed to be controlled by a Chicago firm, which charges a royalty of $10 per mile for its use for the first application; no charge being made for subsequent sprinklings.

Few electric roads have used oil. The Los Angeles Pacific reports its use on unpaved city streets and states that three coats per year are desirable. At 60 cts. per barrel, the cost per mile of double track is $100. San Francisco reports its successful use on macadam streets outside the city limits. The Brooklyn Rapid Transit Co. is experimenting with twenty miles of track on its suburban lines on private right-of-way where the pleasure riding is very heavy and the roadbed of sandy material.

From the reports of roads using oil, it appears that managers of the steam roads, at least, do not consider its use profitable and there is no general movement to adopt it. On electric roads on private right-of-way or on macadam outside of built-up sections of cities, it may prove to be economical where the oil is obtained at a low price, especially on sandy roads leading to pleasure resorts. The accompanying memoranda in regard to the practice and cost may be of interest.

Boston & Maine Railroad: Used oil in 1899; covered about 400 single-track miles; uses 2,000 to 3,000 gallons per mile; price of oil, 2.75 cts. per gallon; average cost, $100 per mile.

Boston & Albany Railroad: Made experiments for three years, 1898-1900; used 2,000 gallons per mile first year, 600 gallons second year, 1,000 gallons third year; oil per gallon, 2.75 cts.; cost per mile of track, $80.

Long Island Railroad: Use oil on crossings; cost, $125 per mile; use 600-gallon tank cars; oil costs 2.4 cts. per gallon; 600 gallons used per mile; results on cinder and gravel ballast satisfactory.

Delaware & Hudson Railroad Co.: From 1896 to 1900 oiled road from Saratoga to Pittsburg, 188 miles; used roadbed oil prepared by the Standard Oil Co.; price, 2.75 cts. to 4.75 cts. per gallon; for 2,000 gallons per mile cost was $100; kept dust down, but its use has been given up; 1,000 gallons per mile every other year would be sufficient.

Southern Pacific Railroad Co.: Has used oil for five or six years; 900 miles of track oiled; may use up to 4,000 gallons per mile; pays $10 per mile royalty.

Los Angeles Pacific Co.: In Los Angeles on unpaved streets an occasional coat of oil is applied; generally, oiled streets are sprinkled three times per year; cost, $100 per mile of double track.

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[*] Extracts from a paper read before the American Street and Interurban Railway Engineering Association, at Atlantic City, N. J., Oct. 14-18, 1907, by L. Wilson, Engineer Twin City Rapid Transit Co., Minneapolis, Minn.

Snow Removal.—The universal practice with reference to snow is to keep the tracks open for service by the use of plows and sweepers during and immediately after each snowfall. The snow thus deposited on the rest of the roadway is left, so far as it can be done, without impeding travel. At crossings and congested points in business districts all companies assist in removing snow as promptly as possible by the use of cars and teams.

When it is necessary to remove snow from roadway the companies generally pay the cities one-third or one-half the expense incurred on the whole street. In some cases the cities and railway companies divide the streets, the railways taking care of a sufficient number of them to make up the same area as their total track allowance. One company takes one side of the streets and changes side annually. This is reported as working well in a city of 60,000 people.

In many cities no separate account of cost is kept, and owing to the fact that conditions vary so widely between southern and northern locations, no satisfactory comparison of costs is practical. Figures given show results of:

$17.41 per mile of single track in a city of 175,000 with 140 miles of track in the Central States (Indianapolis) for an average winter. In Chicago, 1906-7, the cost was $41.13 per mile for the Chicago City Railway Co., while in Milwaukee, 85 miles away, but a very small expense was incurred. Another lake city, Detroit, reports $35 per mile for an average winter. Duluth gives $45.45 for an average winter. Toronto reports on 98 miles of single track in 1904-5, a cost of $102.04 per mile for one-third of street area. Providence, R. I., reports a cost of $148 per mile of single track in 1906 and 1907. Here all snow over 4 ins. in depth is removed.

The following comparative costs of locomotive repairs are given by Mr. J. E. Muhlfield; the records cover periods of from 1½ to 2½ years:

No. of Locos.	Kind of Loco.	Weight lbs.	Traction power lbs.	Repairs per 100 miles.
3	Electric	196,000	28,000	$19.20
2	Electric	320,000	70,000	12.70
1	"Mallet"	335,000	74,000	5.75
35	"Pacific"	230,000	35,000	4.35

Compared on the basis of 1,000 lbs. of rated traction power at 10 miles per hour the following results were obtained:

	Per 100 Miles
3 Passenger electric locomotives	$0.68
2 Freight electric locomotives	0.18
35 Passenger steam (Pacific) locomotives	0.125
1 Freight steam (Mallet) locomotives	0.08
Freight steam (Consolidation) locomotives	$0.075

Cost Records, Estimates and Public Contracts.

By George C. Warren.*

The editorial on page 310 of the Dec. 4th, 1907, issue of Engineering Contracting is especially interesting and valuable. The fault of "guess work" and "lump" estimates is not only entirely too common with engineers, but with responsible contractors as well. In this fault, I believe lies the root of nearly all the poor work which is found in nearly every branch of construction. My observation is that while a few contractors base their bids on carefully prepared detailed estimates of cost, including suitable allowance for contingencies, such as installation of and repairs to plant, operating expenses, surety company bond premiums, guaranty reserves, employes' liability insurance, interest on investment, etc., etc., and a fair percentage of profit added, by far the great majority of contractors base their bids on either:

1st. The official estimate of the engineer, which itself is very often based on the cost or contractors' prices on other somewhat similar work, but in details of cost and construction liable to be very different in the same or some other city or vicinity, and often a year or more back, without giving consideration to differences of conditions or changes, whether more or less, in cost of labor and materials. It should be noted that in municipal work the laws are, in many cases, such that the engineer's estimate cannot be exceeded in letting the contract. Even where the law does not thus limit the bid, however much too low the engineer's estimate may be, he is pretty apt to be jealous of his estimate and insist on its correctness and fairness in case bids are materially above the estimate.

2nd. The prices of other bidders or of other contractors on somewhat similar work in the same or other cities.

3rd. The prices it is estimated other contractors will probably bid, or what is necessary to be low bidder, almost regardless and without accurate knowledge of what it may cost to do the work.

At nearly every public letting, some one or more, generally several, contractors base their proposals on consideration of one or all of the above points, rather than a carefully prepared, detailed estimate of cost of every part of the work. The result is that at most lettings there are some wild bids, either much too high or too low, generally both, with the conservative, carefully prepared bids between the two erroneous extremes. Under such conditions, it is only once in a while that the conservative, careful contractor gets the contract when it is let to the "lowest and best bidder."

Here is where the poor work comes in. Most contractors, like most other business men, would prefer to be honest, rather than dishonest—prefer to do good work rather than poor work. But when a contractor finds he has made a mistake in his bid and is losing money, unless he is more honest than the average of humanity, he will "squirm" and bend his utmost efforts to prevent the loss or reduce it as much as possible. In other words, he will take it out of the work, and it is a pretty good engineer or inspector who can stop him doing so, to some degree, at least,

Within the past three weeks, an experienced contractor in an important field of municipal work, said to the writer: "Competition in my business has become so keen that we are obliged to figure to steal what we make, contractors generally bidding the prices, or even below the prices, at which they figure the work can be done for in strict compliance with the specifications."

A few years ago, a well known contractor who was a "Past Master" at making money, whether his prices were high or low, who I had frequently met in competition, and who, from what I had seen of his bids, I believed systematically figured on "what is necessary to be low bidder" almost regardless of cost, is reported to have said to a mutual friend: "The successful contractor is the man who can turn a bad contract into a good one."

I believe the public, engineers, officials and others having to do with public work, will subscribe to the sentiment that "It is not to the interest of the party paying for the work to have contracts let at prices less than is consistent with first-class work and a reasonable profit." Yet how frequently it happens, especially in public work, when the lowest bidder is manifestly too low, and believed so to be by the engineer and other officials letting the contract, that they say: "But he is responsible and will furnish a good bond, and our duty is to save money for the public." And when contracts are let to such a bidder, how frequently it happens that after the work is completed and paid for (perhaps years after) it is found to be of very poor quality. Frequently it happens that the matter does not go that far and that the contractor is either bankrupted or, as I have known in some cases, pockets his first large estimate, quits the state or country without paying for labor and materials, and leaves the work to the tender care of the owner, creditors and bondsmen. Occasionally, a contractor in such a case "takes his medicine," and if he has the financial ability, completes the work and does it as well as if he were making a good profit. But that is not "human nature," and in most cases is not within the ability of the engineer to enforce. If engineers and others having charge of letting contracts would be as solicitous to see that contracts are not let at too low prices, as they generally are to see that the prices are not too high, it would frequently, if not generally, result in better work and results far more satisfactory to all parties concerned.

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Before closing, I wish to comment on another point I noticed has been brought out, forcibly in recent issues of Engineering-Contracting. I refer to the importance, in letting contracts, of providing separate unit prices for every class of work embraced in the contract. I well remember a case in a contract in which I was interested, one item of which was "rock excavation per cubic yard," the quantity being about 100,000 cu. yds., and included the following distinct different classes of work:

1st. Excavation from a side hill along side of and above the surface of a river, so located that about half the rock could be blown by the explosives into the river and thus "wasted" at little expense.

2nd. Excavation in a trench, about a mile long, 8 ft. wide, and varying in depth, from 4 ft. to 10 ft. for a large pipe. This pipe excavation itself varied in conditions: (a.) Waste by derrick alongside trench. (b.) Haul a maximum limit set by the contract of 2,000 ft. and a portion of the excavated work spread so as to form the foundation of a road.

3rd. Excavation below water for the base of a 6,000 cu. yd. dam.

4th. Excavation partly below water for a power house with no opportunity to "waste" the material, except to use it for building a narrow road, making a fill about 10 ft. deep alongside the river.

5th. Excavation for spillway around the dam, portions of the rock to be: (a.) Put directly through the crusher fed by derricks direct from the excavation, for use in the concrete dam. (b.) Hoisting out of the spillway excavation and wasting within 2,000 ft.

It will be readily seen that this item of rock excavation included at least nine distinctly different classes of work, varying as widely in cost as from 70 cts. to $4 per cubic yard. It is true that approximate profiles were given, from which contractors could compute what they supposed would be approximate quantities of each class of rock excavation, and the specifications gave approximate estimates of the engineer, dividing the excavation into three classes, but the contract and specifications contained the usual clauses in the interest of the owner, providing "That lines and grades may be changed as the engineer may direct" and "contractors must satisfy themselves by personal examination of the correctness of the estimates."

In fact, the lines and grades and quantities of work of the several classes were so changed that the percentages of each class bore little semblance to the preliminary estimates, resulting in a heavy loss to the contractors, for which their attorneys advised they had no redress, and the owner and engineer would not make any extra allowance.

Other important items in the contract were so classified as to not give a proper division of unit prices.

Besides dividing and sub-dividing all classes of work, which it is known will be required, into separate unit prices, with quantities *estimated as closely as possible*, contracts should also provide for "extra work *which may possibly be required*, either: (a.) At a schedule of unit prices, to be agreed on in advance and made a part of the contract, or, (b.) A provision for payment of cost, plus 15 per cent.

Some cities put in all specifications a schedule of prices prepared by the engineer, to be paid for "extra" work, and covering every item which would be at all likely to be encountered. This is a good and mutually fair plan, provided the prices are sufficiently carefully and intelligently considered so as to provide both a fair margin and not excessive profit to the contractor.

A Gutter Plow, Snow and Ice Cleaner and Road Machine Combined.

A machine or tool is often designed for a special purpose and is found to be not only a success for that work, but also for many other purposes. This has been so to a remarkable degree in the gutter plow illustrated in Figs. 1 and 2.

This machine, as its name implies, was designed to plow and shape up gutters on dirt and macadam roads. It is said to be an economical tool for this purpose. Two horses and a driver operate it. The blade is strong and cuts both on the bottom and the side. The blade being operated and controlled by the driver's foot, leaves his hands free to guide the horses, thus allowing the machine to be driven in a straight line.

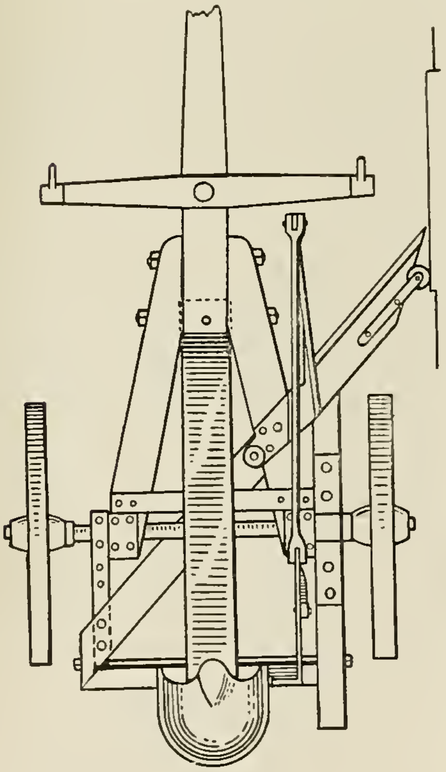

Fig. 2.

City engineers and street cleaning commissioners will find much use for this tool in keeping gutters free of snow and ice. After snowstorms, if the plow is put to work, it will remove snow and ice from gutters, leaving them clean, so that water can flow unobstructed to the catch basins. The plow will work in any depth of snow that horses can travel through. When working in paved streets with curbing, the small roller on the beam prevents the blade from striking against the curb. As a team can travel about 20 miles per day, it is possible to open up and clean gutters on each side of 10 miles of streets.

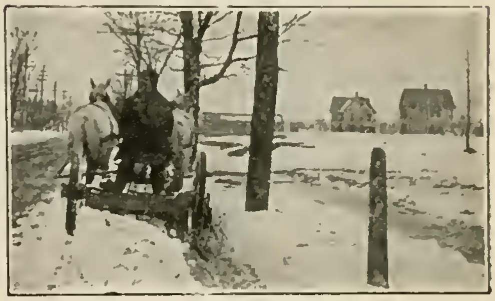

Fig. 1.

In shaping roadbeds for macadam and Telford paving, this machine will also be found useful. Not only can the bottom be scraped and shaped, but also the side of a small bank can be cut down to be handled with shovels or scrapers. Where a shoulder is to be left on the roadbed, this gutter plow can shape the shoulder without hand work, as the work that it is doing in Fig. 1 shows.

A second blade can also be attached to the machine, just under the hounds, and at right angles to them. It fits closely against the gutter blade, and a controller at the left of the driver allows him to raise and lower this attached blade. With this the machine becomes a road machine. This allows of other uses being made of it, such as those that road machines are put to, namely, shaping roadbeds, spreading loose dirt, and cutting turf and sod from the ground.

Such a machine could also be used for spreading macadam on new wagon roads. This operation of spreading macadam usually costs from 5 to 10 cts. per cu. yd. but such a machine should reduce the cost to less than 2 cts. When this machine has the second blade attached to it it can still be operated by two horses, although some engineers and contractors have added a second pair of wheels and used 4 horses.

The machine with one blade weighs 800 lbs.; with the second blade attached the weight becomes 1,000 lbs. The manufacturers of this gutter plow and leveler are the J. H. Strain Co., 12 Elm street, New York City.

Forest Preservation in France.

The importance of forest preservation has been recognized for a long time in France. As early as 1824 the National School of Waters and Forests was founded at Nancy, for no other purpose than to provide men for the higher branches of the public forestry service. The Republic for forestry purposes is divided into 32 conservations and the work is directed from the Ministry of Agriculture by a director and three administrators. Their duties include the conservation, exploitation and amelioration of public forest lands; the fixation of dunes upon the maritime littoral; the replanting of trees in mountains and the correction of mountain torrents; the regulation of the pasture lands of the communes, and the utilization of water in pastoral and forest regions, and the surveillance of river fishing and fish culture. Each of the 32 conservations is in charge of a conservator, aided by an adjutant inspector. The conservations are divided into "chefferies," each administered by an inspector or adjutant inspector, and there are again subdivided into "cantonnements," with adjutant inspectors or general guards in control. Each of these higher officers—32 conservators, 200 inspectors, 215 adjutant-inspectors, 260 general guards, and 40 licentiate general guards—has appropriate military rank. They direct the transactions of a considerable army of foresters of various grades and classes, of whom 3,300 are recruited and paid by the National government, and many more by the communal governments.

At the present time a total surface of 7,429,873 acres is under the direct control of the forestry service, of which 6,771,650 acres consist of forests properly so called. The far greater proportions of the forest area—4,565,434 acres—belongs in fee to the communes, but is under the rigid control of the state, experience having demonstrated that the communal governments could not be relied upon to maintain the public property.

Press reports state that the English turbine torpedo boat destroyer Tartar at a trial over the official course at Southampton, England, attained a speed of 37.037 knots per hour. In a six hours' trial the boat covered 233 miles.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write direct to the advertisers and state that you saw the catalog mentioned in *Engineering-Contracting*. If you are in the market for tools, machinery or supplies tell us and we will notify promptly the leading manufacturers.

No. 0499. **Hand Power Derricks.**—Parker Holst & Machine Co., 958 North Francisco Ave., Chicago, Ill.

This 24 page pamphlet illustrates and describes in some detail the special hand power derrick made by the above named company. This derrick is designed particularly for use in handling concrete blocks. A number of illustrations are given showing the installation of the derrick on concrete block building work. The catalog gives testimonial letters from a number of users of the derrick and also gives prices, dimensions, capacity, etc.

No. 0500. **Industrial and Mine Cars.**—Kilgore-Peteler Co., Minneapolis, Minn.

This pamphlet contains 56 pages of illustrations and descriptive matter relating to the large line of cars made by the above named company. The company manufactures cars for handling all classes of material on narrow gage railways. The pamphlet describes the construction of these cars in a general way, and also gives dimensions, capacity, etc., for each type of car made. It is interesting to note that the Peteler car was first made in Germany in 1866.

No. 0501. **Hoisting and Conveying Machinery.**—The Brown Hoisting Machinery Co., Cleveland, Ohio.

This is a cloth-bound book containing 196 pages. It illustrates profusely and describes in general detail the class of hoisting and conveying machinery made by the above named company for heavy work, such as blast furnaces, loading ore and coal from cars to vessels and handling all classes of heavy material in bulk. The catalog is excellently printed, and is well worth securing by any engineer interested in this class of machinery.

No. 0502. **Dump Wagons and Carts.**—The Columbia Wagon Co., Columbia, Pa.

This is a catalog of 66 pages devoted entirely to wagons and carts of all kinds. The list includes farm wagons, loggers' wagons and dump wagons and carts of all kinds. The sizes of all parts of each wagon are given in tabular form, and there are also tables showing the capacity and shipping weights of the wagons. Practically every kind of wagon for heavy hauling purposes is made by the company and is described in this catalog.

No. 0503. **Steam Pumps.**—A. S. Cameron Steam Pump Works, New York City, N. Y.

Under the title of the "Pennsylvania Railroad Tunnels and Terminals in New York City," this company has printed a very handsome pamphlet illustrating and describing the several large railroad tunnels now being built at New York City. A map is given showing the routes of the tunnels and there are views of the tunnel work in various stages of progress. As a handy compendium of the main facts and figures relating to the several tunnels under construction at New York City this pamphlet is worth securing. Incidently it shows the various pumping plants using Cameron Steam Pumps which have been installed in this tunnel work.

No. 0504. **Portable Industrial Railways.**—Arthur Koppel Co., Chronicle Building, San Francisco, Cal.

This is a 25 page catalog illustrating and describing track and cars for industrial railways. A comparative cost of moving earth by such cars and track, with that of wheel scrapers, is given. The adaptability of such railways for excavation, concrete, coal handling, mining, tunnel, factory and many other kinds of work is shown. The catalog is of interest to engineers and contractors.

No. 0505. **The Empire Hand Prospecting Drill.**—New York Engineering Co., 2 Rector St., New York.

This is a beautifully gotten up pamphlet of 50 pages, illustrated with many halftone cuts. It describes the method of using this prospecting drill, under difficult circumstances, where it is not possible to carry other drills. It is operated by men and horses. Test holes can be put down to a depth of more than 100 ft. showing the materials encountered.

No. 0506. **Carey's Coverings.**—The Philip Carey Co., Lockland, Cincinnati, O.

This is a 70 page catalog of neat appearance. It illustrates the successful use of these coverings for hot and cold pipes, for boilers and locomotives, and other purposes. The catalog also describes and lists several kinds of packings, theatre curtains, and roofing. Various kinds of asbestos and magnesia products are illustrated.

No. 0507. **Verschoyle Patent Transit.**—Taylor Bros. Co., Rochester, N. Y.

This is a small 20-page catalog illustrating and setting forth the merits of the Verschoyle Patent Transit, which allows of the reading of the magnetic bearing and the vertical angle at one observation. Some useful formulas and tables are given in the pamphlet.

No. 0508. **Rock Drills.**—McKiernan Drill Co., 170 Broadway, New York, N. Y.

This is a 30-page pamphlet of the rock drills manufactured by this company. All accessories of rock drills are also listed and illustrated. The pamphlet can readily be carried in the pocket, thus allowing drill runners and foremen to have it convenient for reference in ordering supplies.

No. 0509. **Concrete Block Machines.**—California Artificial Stone Supply Co., Los Angeles, Cal.

The block machine made by this company is of the face down type and special claims are made for the excellent appearance of the rock face broken range and ashlar blocks which it produces. The construction and operation of the machine are described and a number of interesting views are given of buildings constructed from blocks produced by it. The work as shown by the photographs is among the best that we have seen.

Personals.

E. B. Reynolds, a well known Western railway contractor, died Dec. 7, at his home in Wymore, Neb.

Mr. Charles E. Wells, of White Plains, N. Y., has been appointed a Division Engineer by the Board of Water Supply of New York City.

Mr. F. A. Peckham, Sales Manager of the Cincinnati Equipment Co. of Cincinnati, has been elected vice President of the Wm. J. Oliver Mfg. Co., of Knoxville, Tenn.

Mr. William J. Carter has resigned his position as City Enginer of Cleveland, O., in order to engage in private practice. Mr. Robert Hoffmann succeeds Mr. Carter as City Engineer.

Mr. Max Feldman has been appointed an Assistant Engineer in the Bureau of Buildings, Manhattan Borough, New York City.

Mr. O. F. Cole has been appointed Chief Engineer of the Chicago Junction Ry., with offices at Chicago, Ill., succeeding Mr. J. B. Cox, resigned.

Messrs. Wm. H. Renck, Wm. A. Painter, Oscar Clement Hearwig, Silas O. Rogers and Frank E. Slabaugh have formed the Columbus Bridge & Iron Co. of Columbus, O., and will manufacture and erect bridges and substructures of all kinds and do a general contracting and construction business.

Mr. B. W. Seymour, formerly Engineer for Swift & Co., Chicago, and Mr. C. E. Apple, formerly Bridge Engineer for the M. & O. R. R., have opened offices in the First National Bank Bldg., Birmingham, Ala., and will engage in general engineering work, giving special attention to steel and concrete construction.

Technical Literature, a monthly magazine of technical information for engineers, designers and contractors, established by Mr. Harwood Frost and published by him at 220 Broadway, New York, will with its January issue appear under its new name of The Engineering Digest. The magazine will continue to be edited by Mr. Frost and Mr. Charles M. Sames, the publication office being as before, at 220 Broadway.

Sir William Thompson, Lord Kelvin, the noted scientist, died Dec. 17, in Glasgow, aged 83 years. Lord Kelvin's versatility as a mathematician, electrician, inventor, experimenter, engineer and teacher place him among the most remarkable men of his age. There were few branches of scientific thought which were not deeply indebted to him, and mathematicians, mechanics, sound, light, heat, thermodynamics, magnetism, electricity, elasticity, electrical engineering, telegraphy, geology, astronomy, chemistry and navigation were fields in which he was a potent leader.

Thomas Fitch Rowland, a well known engineer, died Dec. 13 at his home in New York City, aged 76 years. In early life Mr. Rowland was a fireman and engineer on N. Y., N. H. & H. R. R., leaving this road to become an engineer on a steamboat. In 1852 he became a draftsman with the Allaire Iron Works in New York, leaving this company to become General Superintendent of the Atlantic Dock Iron Co., of Brooklyn, N. Y. In 1859 he went into business for himself, establishing the iron works at Greenpoint, N. Y., which in 1887 he incorporated as the Continental Iron Works and of which he became President and General Manager. During the Civil War he did much iron construction work for the Government. His work for which he was perhaps best known was the construction in 1862 of the famous "Monitor," after the designs of John Ericsson. Mr. Rowland was a member of the American Society of Civil Engineers, and was donor to that society of the Thomas Fitch Rowland Prize. He was also a member of the American Society of Mechanical Engineer.

CONTRACT NEWS

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We shall welcome any news notes that our readers may send in. Notes of contracts awarded, bidding prices, etc., will be especially acceptable.

BIDS ASKED

Bridges.

Dec. 27.	Baltimore, Md.	Dec. 11
Dec. 27.	Troy, O.	Dec. 25
Dec. 28.	Washington C. H., O.	Dec. 25
Dec. 30.	Savannah, Ga.	Dec. 11
Dec. 30.	Indianapolis, Ind.	Dec. 25
Dec. 31.	Victoria, B. C.	Dec. 18
Jan. 2.	New Orleans, La.	Dec. 4
Jan. 2.	Grants Pass, Ore.	Dec. 18
Jan. 2.	Forrest City, Ark.	Dec. 18
Jan. 3.	West Union, O.	Dec. 18
Jan. 3.	Tipton, Ia.	Dec. 25
Jan. 6.	Fort Monroe, Va.	Dec. 11
Jan. 6.	Colfax, La.	Dec. 11
Jan. 6.	Hammond, Ind.	Dec. 18
Jan. 6.	Gadsden, Ala.	Dec. 25
Jan. 7.	Castle Haynes, N. C.	Nov. 20
Jan. 7.	Salem, S. Dak.	Nov. 27
Jan. 7.	Creston, Ia.	Dec. 25
Jan. 8.	Waseca, Minn.	Dec. 18
Jan. 8.	Ocala, Fla.	Dec. 25
Jan. 10.	Wayne, Neb.	Dec. 18
Feb. 13.	St. Charles, Mo.	Oct. 30

Buildings.

Dec. 26.	Richmond, Va.	Dec. 4
Dec. 26.	New York, N. Y.	Dec. 18
Dec. 27.	Tulalip, Wash.	Nov. 27
Dec. 27.	Tulalip, Wash.	Nov. 27
Dec. 27.	San Francisco, Cal.	Dec. 4
Dec. 27.	Allentown, Pa.	Dec. 11
Dec. 27.	Chicago, Ill.	Dec. 18
Dec. 27.	Philadelphia, Pa.	Dec. 25
Dec. 28.	Milwaukee, Wis.	Dec. 18
Dec. 28.	Chicago, Ill.	Dec. 18
Dec. 29.	Viola, Kan.	Dec. 18
Dec. 30.	Lancaster, Pa.	Nov. 13
Dec. 30.	Monterey, Cal.	Dec. 11
Dec. 30.	Edwardsville, Pa.	Dec. 18
Dec. 30.	Fredonia, N. Y.	Dec. 25
Dec. 31.	Philmont, N. Y.	Dec. 18
Dec. 31.	St. Louis, Mo.	Dec. 25
Jan. 2.	Flint, Mich.	Nov. 13
Jan. 2.	South Bend, Ind.	Nov. 20
Jan. 2.	Milwaukee, Wis.	Dec. 18
Jan. 3.	Albuquerque, N. Mex.	Nov. 20
Jan. 2.	Milwaukee, Wis.	Dec. 25
Jan. 5.	West Allis, Wis.	Dec. 25
Jan. 6.	Wichita, Kan.	Nov. 27
Jan. 6.	Cincinnati, O.	Dec. 4
Jan. 8.	Fort Spokane, Wash.	Nov. 27
Jan. 8.	Trenton, N. J.	Dec. 25
Jan. 9.	Trenton, N. J.	Dec. 18
Jan. 9.	Newark, O.	Dec. 25
Jan. 10.	Cheyenne Agency, S. Dak.	Nov. 27
Jan. 10.	Punta Gorda, Fla.	Dec. 18
Jan. 11.	Fort Smith, Ark.	Dec. 18
Jan. 13.	Fort Monroe, Va.	Dec. 18
Jan. 13.	Fort Wood, N. Y. H.	Dec. 18
Jan. 13.	Santa Fe, N. Mex.	Dec. 18
Jan. 14.	York, Neb.	Dec. 11
Jan. 14.	Newport, R. I.	Dec. 25
Jan. 14.	Fort Andrews, Mass.	Dec. 25
Jan. 15.	Winnibago, Neb.	Dec. 4
Jan. 15.	Martinsburg, W. Va.	Dec. 11
Jan. 15.	Houston, Tex.	Dec. 11
Jan. 17.	East Liverpool, O.	Dec. 11
Jan. 18.	Pine Ridge, S. Dak.	Dec. 4
Jan. 18.	National Soldiers' Home, Va.	Dec. 25
Jan. 20.	Richmond, Va.	Dec. 11
Jan. 20.	Asheville, N. C.	Dec. 25
Jan. 21.	Gainesville, Ga.	Dec. 25
Feb. 1.	Terre Haute, Ind.	Dec. 25
Jan. 22.	Poplar, Mont.	Dec. 11
Jan. 22.	Mitchell, S. Dak.	Dec. 25
Jan. 24.	Paris, Ill.	Dec. 25
Jan. 30.	Mount Pleasant, Mich.	Dec. 25

Roads and Streets.

Dec. 26.	Harrisburg, Pa.	Dec. 11
Dec. 27.	Amity, Pa.	Dec. 11
Dec. 27.	New Brunswick, N. J.	Dec. 18
Dec. 27.	Baltimore, Md.	Dec. 18
Dec. 27.	Indianapolis, Ind.	Dec. 25
Dec. 30.	New York, N. Y.	Dec. 25
Dec. 30.	Indianapolis, Ind.	Dec. 25
Dec. 31.	Wyalusing, Pa.	Dec. 11
Dec. 31.	Fort Rosecrans, Cal.	Dec. 25
Jan. 2.	Ridgefield, Conn.	Dec. 11
Jan. 2.	Little Rock, Ark.	Dec. 11
Jan. 2.	Tipton, Ind.	Dec. 18
Jan. 2.	St. Paul, Minn.	Dec. 25
Jan. 3.	Salt Lake City, Utah	Dec. 4
Jan. 4.	Lisbon, O.	Dec. 18
Jan. 4.	Cleveland, O.	Dec. 18
Jan. 6.	Logansport, Ind.	Dec. 6
Jan. 6.	Lebanon, Ind.	Dec. 18
Jan. 6.	Danville, Ind.	Dec. 18
Jan. 6.	Crown Point, Ind.	Dec. 18
Jan. 6.	Monticello, Ind.	Dec. 25
Jan. 6.	Vevay, Ind.	Dec. 25
Jan. 7.	Vincennes, Ind.	Dec. 18
Jan. 7.	Paoli, Ind.	Dec. 25
Jan. 9.	Findlay, Pa.	Dec. 25
Jan. 10.	Fort Washington, Md.	Dec. 25
Jan. 11.	Noblesville, Ind.	Dec. 18
Jan. 17.	Washington, Pa.	Dec. 18
Jan. 18.	Fort Washington, Md.	Dec. 18
Feb. 4.	Billings, Mont.	Nov. 27

Sewers.

Dec. 26.	Cleveland, O.	Dec. 25
Dec. 27.	Youngstown, O.	Dec. 18
Dec. 27.	Wilmette, Ill.	Dec. 25
Dec. 27.	Akron, O.	Dec. 25
Dec. 28.	Evansville, Ind.	Dec. 4
Dec. 30.	St. Paul, Minn.	Dec. 25
Dec. 30.	Hartford, Conn.	Dec. 25
Jan. 2.	San Jose, Cal.	Dec. 25
Jan. 3.	Salt Lake City, Utah	Dec. 11
Jan. 3.	Canton, O.	Dec. 25
Jan. 6.	Hanley Falls, Minn.	Dec. 11
Jan. 6.	Durango, Colo.	Dec. 18
Jan. 13.	Steubenville, O.	Dec. 25
Jan. 14.	Clinton, Ia.	Dec. 25

Water Supply.

Dec. 26.	Richmond, Va.	Dec. 25
Dec. 27.	Sauk Rapids, Minn.	Dec. 11
Dec. 27.	Fort Leavenworth, Kan.	Dec. 18
Jan. 1.	Norway, Me.	Nov. 27
Jan. 1.	Orange, N. J.	Dec. 18
Jan. 6.	Fargo, N. Dak.	Dec. 25
Jan. 8.	Tucson, Ariz.	Nov. 27
Jan. 10.	Phoenix, Ariz.	Dec. 11
Jan. 14.	Annapolis, Md.	Dec. 25

Miscellaneous.

Dec. 27.	Boston, Mass.,	Wreck Removal,	Dec. 4
Dec. 27.	Paducah, Ky.,	Tenders,	Dec. 4
Dec. 27.	New York, N. Y.,	Loading Deck Scows,	Dec. 25
Dec. 27.	Indianapolis, Ind.,	Ash and Sweepings Removal,	Dec. 25
Dec. 30.	Dayton, O.,	Conduit System,	Dec. 11
Dec. 30.	Richmond, Va.,	Gas Mains,	Dec. 18
Dec. 31.	Altoona, Pa.,	Garbage Disposal,	Dec. 11
Jan. 1.	Charleston, W. Va.,	Street Lighting,	Dec. 18
Jan. 2.	San Jose, Cal.,	Street Lighting,	Dec. 25
Jan. 6.	Boston, Mass.,	Masonry, Etc.	Dec. 11
Jan. 7.	Reading, Pa.,	Garbage Disposal,	Dec. 18
Jan. 10.	Indianapolis, Ind.,	Monument,	Dec. 11
Jan. 10.	Los Angeles, Cal.,	Hauling,	Dec. 25
Jan. 13.	Fort Wood, N. Y.,	Removing Buildings,	Dec. 25
Jan. 14.	Portland, Ore.,	Light Station,	Nov. 27
Jan. 14.	Columbus, O.,	Garbage Works,	Dec. 4
Jan. 18.	New York, N. Y.,	Dry Dock,	Dec. 18
Jan. 9.	Fort Huachuca, Ariz.,	Swimming Pool,	Dec. 18
Jan. 10.	Wilmington, N. C.,	Dump Scows,	Dec. 18
Feb. 11.	St. Louis, Mo.,	Garbage Reduction,	Dec. 18
Jan. 20.	Cincinnati, O.,	Lock and Dam,	Dec. 25
Feb. 4.	Erie, Pa.,	Steamboat Landing,	Dec. 25
May 1.	Buenos Aires, Argentina,	Subways,	Nov. 20

Excavation, Earth and Rock.

Dec. 27.	Jefferson, Ia.	Drains,	Dec. 25
Dec. 30.	Mount Kisco, N. Y.,	Vault Pans,	Dec. 25
Dec. 31.	Greenwood, Miss.	Drainage Work,	Dec. 25
Jan. 7.	De Smet, S. Dak.,	Ditch Work,	Dec. 11
Jan. 7.	Aitken, Minn.,	Ditch Work,	Dec. 25
Jan. 11.	Washington, D. C.,	Dredging,	Dec. 18
Jan. 15.	Fort Hamilton, N. Y.	Grading, Etc.	Dec. 25
Jan. 16.	Detroit, Mich.,	Dredging,	Dec. 18
Jan. 16.	Estherville, Ia.	Drain,	Dec. 25
Feb. 1.	Ottawa, Ont.,	Trent Canal,	Dec. 18

Materials, Machines, Supplies, Tools, Etc.

Dec. 26.	Annapolis, Md.,	Tile,	Dec. 18
Dec. 26.	Washington, D. C.,	Granite Curbing,	Dec. 25
Dec. 27.	Washington, D. C.,	Pipe, Chain, Rope, Etc.,	Dec. 4
Dec. 27.	New York, N. Y.,	Vacuum Cleaning System,	Dec. 11
Dec. 27.	Brooklyn, N. Y.,	Timber,	Dec. 18
Dec. 28.	Chicago, Ill.,	Switchboard, Etc.	Dec. 18
Dec. 30.	New York, N. Y.,	Lumber, Fittings, Etc.,	Dec. 25
Dec. 30.	Columbus, O.,	Wire and Cable,	Dec. 25
Dec. 30.	Chicago, Ill.,	Boilers,	Dec. 25
Dec. 30.	Washington, D. C.,	Pipe, Valves, Etc.,	Dec. 25
Dec. 31.	Pittsburg, Pa.,	Mechanical Stokers,	Dec. 25
Jan. 2.	Washington, D. C.,	Steam Gages, Valves, Etc.,	Dec. 11
Jan. 2.	Jersey City, N. J.,	Broken Stone, Wire, Etc.,	Dec. 11
Jan. 2.	Winnipeg, Man.,	Pump,	Dec. 18
Jan. 3.	Baltimore, Md.,	Window Guards, Gates,	Dec. 18
Jan. 2.	Puget Sound, Wash.,	Drills, Machinery, Etc.,	Dec. 25
Jan. 3.	Hot Springs, S. Dak.,	Vitrified Pipe,	Dec. 25
Jan. 6.	Washington, D. C.,	Engine, Brick, Etc.,	Dec. 18
Jan. 7.	Washington, D. C.,	Portland Cement,	Dec. 25
Jan. 11.	Washington, D. C.,	Furniture, Etc.,	Dec. 25
Jan. 13.	Washington, D. C.,	Sanitary Fixtures, Cars, Jacks, Etc.	Dec. 25
Jan. 14.	Pensacola, Fla.,	Drills, Lumber, Etc.,	Dec. 25
Jan. 15.	Manila, P. I.,	Pumps and Motors,	Oct. 30
Jan. 15.	Winnipeg, Man.,	Water Pipe,	Dec. 4
Jan. 15.	Washington, D. C.,	Pumps, Motors, Cranes, Etc.,	Dec. 11
Jan. 15.	Grand Rapids, Mich.,	Stone,	Dec. 18
Jan. 18.	Providence, R. I.,	Vacuum Cleaning System,	Dec. 25

BIDS ASKED

Bridges.

Gadsden, Ala.—Until Jan. 6, by County Commissioners, for constructing steel bridge over Wills Creek near Attalla. Bridge is to cost $5,000 and will replace present structure.

Ocala, Fla.—Until Jan. 8, by S. T. Sistrunk, County Clerk, for bids for construction of steel bridge over Blue River, near Dunnellon, Fla.; also steel bridge over Withlacooche River at Stokes Ferry. Plans and specifications on file at office of Austin Bros., Architects, Atlanta, Ga.

Indianapolis, Ind.—Until 10 a. m., Dec. 30, by C. J. Clark, County Auditor, for the construction of concrete abutments and pier for bridge over Little Eagle Creek and for two concrete steel culverts over Plaff's branch near West Newton.

Creston, Ia.—Until Jan. 7, by County Supervisors, for labor and material for erecting all bridges required by county during ensuing year. Bids are also asked for steel pipe and cement work required during 1908.

Tipton, Ia.—Until Jan. 3, by County Supervisors, for steel bridges, piling and lumber for ensuing year.

Troy, O.—Until Dec. 27, by E. A. Pearson, County Auditor, for constructing superstructure of hand lift bridge over Miami Canal on Water St.

Washington, C. H., O.—Until Dec. 28, by County Auditor, for construction of a 90½x11-ft. steel bridge over Rattlesnake Creek, on County Road, near Chas. Perrill's.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Gainesville, Ga.—Until 3 p. m., Jan. 21, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction (complete) of the U. S. Post Office at Gainesville, Ga.

Terre Haute, Ind.—Until Feb. 1. according to reports,. by J. G. Vrydaugh, Architect, 705 Ohio St., for the construction of 2 story additions to each of the following school buildings in Terre Haute: The Highland, the Fairview and the Greenwood buildings.

Paris, Ill.—Until Jan. 24, by Board of Education for erection of high school building on South Main St.

Fort Andrews, Mass.—Until 10 a. m., Jan. 14, by Capt. Ira L. Fredendall, Constructing Q. M., 263 Summer St., Boston, Mass., for the construction, plumbing, heating, electric wiring and electric lighting fixtures of one brick barrack building at Fort Andrews, Peddock's Island, Boston Harbor, Mass.

Mount Pleasant, Mich.—Press reports state that bids are being asked until Jan. 30, by Luther L. Wright, for the construction of a physical training building for the Central Michigan Normal school at this city.

St. Louis, Mo.—Until Dec. 31, by Board Public Improvements, W. B. Dryden, Secretary, for letting No. 8943—furnishing all materials, tools and labor necessary for installation of certain plumbing at City Insane Asylum on Arsenal St. Deposit $250 required.

Asheville, N. C.—Until 3 p. m., Jân. 20, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction (complete) of the extension to the U. S. Post Office and Court House, Asheville.

Trenton, N. J.—Until 3 p. m., Jan. 8, by James Knox Taylor, Supervising Architect, Washington, D. C., for the steam heating apparatus, etc., complete in place, for the U. S. Post Office and Court House and extension thereto at Trenton, N. J.

Fredonia, N. Y.—Until noon, Dec. 30, by Dr. Andrew S. Draper, Commissioner of Education, Capitol, Albany, N. Y., for alterations to gymnasium building—construction, heating and plumbing—State Normal School, Fredonia. Plans, etc., at Fredonia, and with State Architect, at Albany, N. Y.

Newark, O.—Until Jan. 9, by Board of Education for plumbing and sewerage, and electric wiring for annex to the high school in this city. David M. Keller, Clerk.

Philadelphia, Pa.—Until Dec. 27, by Department of Health, City Hall, for building work, drainage, etc., at Municipal Hospital.

Newport, R. I.—Until Jan. 14, by Bureau Supplies and Accounts, Navy Department, Washington, D. C., for constructing stable at naval station, Newport. Applications for proposals should refer to Schedule 655.

Mitchell, S. Dak.—Until 3 p. m., Jan. 22, by James Knox Taylor, Supervising Architect, Washington, D. C., for the construction (including plumbing, gas-piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Mitchell.

National Soldiers' Home, Va.—Until 1:30 p. m., Jan. 18, by John T. Hume, Treasurer, Southern Branch, N. H. D. V. S., National Soldiers' Home, Va., for furnishing all material and labor for constructing a swill tank house at hospital kitchen and remodeling swill house and installing swill tank at mess hall kitchen.

West Allis, Wis.—Until noon, Jan. 5, by Board Public Works, F. Phillips, Jr., Chairman, for furnishing and installing heat regulation system in new First Ward school building.

Milwaukee, Wis.—Until 5 p. m., Jan. 2, by Board of School Directors, Frank M. Harbach, Secretary, for labor and material for erection of 20-room school building on corner of Lloyd and 13th Sts.

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Fort Rosecrans, Cal.—Until noon, Dec. 31, by Lieut. B. H. L. Williams, Constructing Q. M., for construction of macadam roadway and gutters.

Indianapolis, Ind.—Until 10 a. m., Dec. 27, by Board Public Works, for five contracts for grading and paving sidewalks.

Indianapolis, Ind.—Until 10 a. m., Dec. 30, by Board Public Works, for grading and paving roadway of portion of Cruse St., grading and paving sidewalks on Irvington Ave.; grading, graveling and rolling roadway of first alley east of Madison Ave.; grading and paving roadway of Maryland St.; grading and paving sidewalks of Lowell Ave.

Monticello, Ind.—Until noon, Jan. 6, by J. L. Ackerman, County Auditor, for grading, draining and paving with gravel on road in Prairie Township.

Paoli, Ind.—Until 2 p. m., Jan. 7, by Commissioners of Orange County, for constructing a gravel road, 9,200 ft. long.

Vevay, Ind.—Until 2 p. m., Jan. 6, by Levin J. Woolen, County Auditor, for constructing gravel road, 3,870 ft. long, in Cotton Township.

St. Paul Minn.—Until 2 p. m., Jan. 2, by R. L. Gorman, Clerk Board Public Works, for grading portions of Ocean St., Agate St., and Louisa St.

New York, N. Y.—Until 2 p. m., Dec. 30, by John H. O'Brien, Commissioner Water Supply, Gas and Electricity, 13 Park Row, for furnishing materials, repairing and restoring artificial stone sidewalks and curbing and resetting natural stone curbing. Security required is $500.

Findley, Pa.—Until Jan. 9, by Joseph W. Hunter, State Highway Commissioner, Harrisburg, Pa., for constructing Roseburg Pike in Findley Township, Mercer County .

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

San Jose, Cal.—Until Jan. 2, by City Clerk, for the construction of an intercepting sewer in the First, Second and Fourth Wards, in accordance with plans and specifications on file in the offices of the City Clerk and the City Engineer. Sewer to be of brick, concrete or reinforced concrete pipe.

Hartford, Conn.—Until 2 p. m., Dec. 30, by Board of Contract and Supply, Chas. E. Parker, Secretary, for the construction of Section "B" of the Homestead Ave. intercepting sewer system, consisting of about 2,800 lin. ft. of concrete or brick conduit in tunnel, 4 ft. 9-in. in diameter.

Clinton, Ia.—Until Jan. 14, by City Clerk, for about 3,500 ft. of 12-in. to 36-in. pipe sewer.

Wilmette, Ill.—Until 8 p. m., Dec. 27, by Board Local Improvements, for construction of connected system of relief sewers, with manholes, spillways, catch basins, bulkhead and connections. Specifications at Village Hall, and at office of A. C. Wenban, Room 44, 107 Dearborn St., Chicago.

St. Paul, Minn.—Until 2 p. m., Dec. 30, by Board Public Works, R. L. Gorman, Clerk, for constructing sewer in Maryland St.

Akron, O.—Until noon, Dec. 27, by Board Public Service, Chas. H. Watters Secretary, for constructing sewer in Betz St.; certified check for $100 required with bid.

Canton, O.—Until Jan. 3, by Board Public Service, Thos. M. Pexton, President, for constructing storm water sewer, the work including 1,355 lin. ft. 36-in. brick sewer, 980 lin. ft. 24-in., 740 lin. ft. 20-in., 1,230 lin. ft. 18-in., 935 lin. ft. 15-in., 80 lin. ft. 12-in. vitrified pipe, five manholes on brick sewer, 13 manholes on pipe sewers, and 46 catch basins.

Cleveland, O.—Until 2:30 p. m., Dec. 26, by Cuyahoga County Building Commission, No. 425 Garfield Bldg., for the construction of a deep drainage sewer around the county court house. Plans, etc., with Walter P. Rice Engineering Co., No. 629 Society for Savings Bldg., Certified check for $1,500 required with bid.

Steubenville, O.—Until noon, Jan. 13, by T. W. Vance, Clerk Board Public Service, for constructing sewer in 5th St.; also for sewer in Alley E. Certified check for $100 required with bid.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Annapolis, Md.—Until Jan. 14, by Bureau Supplies and Accounts, Navy Department, Washington, D. C., for water pipe system at this place. Applications for proposals should refer to Schedule 674.

WATER SUPPLY.

Fargo, N. Dak.—Until Jan. 6, by N. C. Fargo, City Auditor, for constructing 6-in. water main in 10th Ave., South, in 4th St., North, and in 8th St., north.

Richmond, Va.—Until 5 p. m., Dec. 26, by Charles E. Bolling, Superintendent of City Water Works for cutting and refilling pipe trenches, laying and re-laying paving over trenches and furnace cinders. Certified check for $1,000 required with bid.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

Estherville, Ia.—Drain.—Until Jan. 16, by the County Auditor, for constructing county drain.

Jefferson, Ia.—Drains.—Until Dec. 27, by County Auditor, for constructing two drains.

Aitkin, Minn.—Ditch Work.—Until Jan. 7, by County Auditor, for constructing Ditch No. 4.

Greenwood, Miss.—Drainage Work.—Until noon, Dec. 31, by G. W. Holmes, President Drainage Commissioners, Court House, for constructing main drains of Ellsberry Drainage District, the work including clearing the right of way and digging about eleven miles of ditches requiring the removal of about 178,000 cu. yds. of dirt. Bids are also asked for construction of main drains of Jones-Walton Drainage District, the work including six miles of ditches requiring removal of 66,000 cu. yds. of dirt.

Fort Hamilton, N. Y.—Grading, Etc.—Until 11 a. m., Jan. 15, by Capt. Chas. T. Baker, Constructing Q. M., Fort Hamilton, Brooklyn, for grading and removing stone wall.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Los Angeles, Cal.—Hauling.—Until 2 p. m., Jan. 10, by Board Public Works for the transportation of 352,470 tons of freight for the Los Angeles Aqueduct. The execution of the contract by the successful bidder involves the construction of a standard, broad gage railroad 155 miles long, at an approximate cost of $2,500,000, from Mojave to Lone Pine, north of Owen's Lake. It is estimated that the freight will amount to 20,000,000 ton miles, which, at the rate of 6 cts. per ton mile, will cost $1,200,000 for its transportation.

San Jose, Cal.—Street Lighting.—Until Jan. 2, by City Clerk, for lighting of the city streets with either gas or electricity, for one, three and five years, beginning July 1, 1908.

Indianapolis, Ind.—Ash and Sweepings Removal.—Until 10 a. m., Dec. 27, by Board Public Works, for collection, removal and disposal of ashes and sweepings for a term of 10 years.

Mount Kisco N. Y.—Vault Pans.—Until 2 p. m., Dec. 30, by John H. O'Brien, Commissioner Water Supply, Gas and Electricity, 13 Park Row, New York, for furnishing, repairing, placing and emptying vault pans, etc., at Mount Kisco, Westchester County, N. Y. Security required is $500.

New York, N. Y.—Loading Deck Scows.—Until noon, Dec. 27, by Foster Crowell, Commissioner of Street Cleaning, 13 Park Row, for furnishing all the labor and materials required for loading and trimming deck scows and other vessels of the department, and for the privilege of sorting and picking over and appropriating certain of the refuse at the dumps. Security required is $5,000.

Fort Wood, N. Y. H.—Removing Buildings.—Until 1:30 p. m., Jan. 13, by Lieut. Wm. W. Bessell, Signal Corps, for purchase and removal of four buildings, viz, double lieutenants quarters, barracks, stable, and recreation hall, at this post.

Cincinnati, O.—Lock and Dam.—Until 2 p. m., Jan. 20, by Lt. Col. J. G. Warren, U. S. Engrs., Room 415 Customhouse, Cincinnati, for raising crest of lock and dam No. 3, Big Sandy River, near Louisa, Ky., and constructing steel gates for the lock.

Erie, Pa.—Steamboat Landing.—Until 3 p. m., Feb. 4, by Clark Olds, President Erie Dock Commission, for furnishing all labor and material for the construction and completion of a public steamboat landing of the Port of Erie, about 548 ft. long and 100 ft.

wide. Work includes all dredging, timber, cribs filled with rock, filling between cribs, concrete walls and brick pavement.

Materials, Machines, Supplies, Tools, Etc.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Pipe, Valves, Etc.—Until 2:30 p. m., Dec. 30, by Lt. Col. H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Circular 409—Cast iron pipe, specials and gate valves.

Washington, D. C.—Portland Cement.—Until 10:30 a. m., Jan. 7, by Lt. Col. H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing Portland cement—Circular 410.

Washington, D. C.—Sanitary Fixtures, Cars, Jacks, Etc.—Until 10:30 a. m., Jan. 13, by Lt. Col. H. F. Hodges, General Purchasing Officer, Isthmian Canal Commission, for furnishing under Circular 411, the following: Sanitary fixtures, pipe fittings, steam traps, flexible joints, valves, bibbs, cocks, gauges, gauge glasses, steam whistles, grease and oil cups, oilers, cutting tools, taps and dies, car wheels, saddle blocks for steam shovels, push cars, jacks, rail benders, track drills, shovels, picks, track tools, timber carriers, cant hooks, sledges, anvils, ice tongs, saws, brooms, scrubbing brushes, squilgees, tallow pots, pails, spring steel, steel tubing, boiler tubes, Banca tin, sheet zinc, sheet brass, boat spikes, nails, tacks, wire rope clips, iron thimbles, wire and wiring material, line material, adhesive tape, wire solder, railroad flags, lantern globes, clocks, etc.

Washington, D. C.—Furniture, Etc.—Until 2 p. m., Jan. 11, by Department of Interior, for supplying hospital furniture, appliances and apparatus, beds, bedding, chairs, tables, desks, chiffoniers, bookcases, file cabinets, refrigerators, fireproof safe, rugs, carpets, portable bath tubs, window screens and shades, metal lockers and toilet room fittings, for the New Freedmen's Hospital at Washington, D. C.

Washington, D. C.—Granite Curbing.—Until 2 p. m., Dec. 26, by District Commissioners, District Bldg., for furnishing the District government 6x20-in. granite curbing during the remaining portion of the fiscal year ending June 30, 1908.

Pensacola, Fla.—Drills, Lumber, Etc.—Until Jan. 14, by Bureau Supplies and Accounts, Navy Department, Washington, D. C., for furnishing a quantity of naval supplies for navy yard here, among which are the following: Schedule 670, boiler tubes; Schedule 671, twist drills, copper sheathing, bolts, yellow pine and white oak lumber, nails, bilge pumps, rivets, spikes, steel bars, washers; Schedule 672, brass valves, hose gate valves.

Chicago, Ill.—Boilers.—Until 11 a. m., Dec. 30, by Department of Public Works, 221 City Hall, for furnishing and erecting three water tube boilers complete with all trimmings and appliances, in the 95th St. sewage pumping station, 95th St. and Erie Ave.

New York, N. Y.—Lumber, Fittings, Etc.—Until 11 a. m., Dec. 30, by John V. Coggey, Commissioner of Correction, 148 E. 20th St., for furnishing and delivering hardware, paints, iron steam fittings, lumber and miscellaneous articles.

Columbus, O.—Wire and Cable.—Until Dec. 30, by Board Public Service, Edw. F. McGuire, Secretary, for furnishing and delivering at the municipal electric light plant cable and wire required for 1,000 kilowatt generator and motor driven exciter.

Pittsburg, Pa.—Mechanical Stokers.—Until 10 a. m., Dec. 31, by James P. Shaw, Director Department of Charities and Correction, for six mechanical stokers, to be applied to six 250 H. P. water-tube boilers, in the new power plant for the Department of Charities and Correction, at Marshalsea, Pa., station, P. C. C. & St. L. R. R. Specifications with John P. Brannan, Assistant Superintendent of the Bureau of Building Inspection, Public Safety Building, corner of Sixth Ave. and Cherry Alley.

Providence, R. I.—Vacuum Cleaning System.—Until 3 p. m., Jan. 18, by James Knox Taylor, Supervising Architect, Washington, D. C., for installation of a vacuum cleaning system for U. S. Post Office, Court House and Custom House at Providence. Copies of drawings may be obtained from Supervising Architect or from Architects Clark & Howe, 72 Waybosset St., Providence.

Hot Springs, S. Dak.—Vitrified Pipe.—Until noon, Jan. 3, by W. A. Tucker, Treasurer, Battle Creek Mountain Sanitarium, N. H. D. V. S., Hot Springs, for furnishing and delivery of vitrified pipe.

Puget Sound, Wash.—Drills, Machinery, Etc.—Until Jan. 2, by Bureau Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at local navy yard, supplies, among which are the following: Schedule 439, pipe bending machines; Schudule 597, drills and ratchets, machine screws, machinists' hammers, sledges and axes; Schedule 579, steam hammers, patternmakers lathe, milling machine, etc., etc.

CONTRACTS LET.

The following contracts have been let recently:

Cedar Rapids, Ia.—Sewers.—M. Ford, for constructing about one mile of sewers north of Grand Ave.

Marion, Ind.—Sewer.—F. M. Benner, for storm water sewer in McClure St.

Hagerstown, Ind.—Electric Light Plant.—Wesley Cornel, for electric light plant for this city.

Fort Wayne, Ind.—Garbage Collection.—Frank Draker, present contractor, for collection of city garbage for another year.

Sparta, Minn.—Railroad Spur.—Cal Hall & Co., Duluth, Minn., for building a spur to the Corsica mine for Iron Range R. R.

Minneapolis, Minn.—Steel Bridge.—Minneapolis Steel & Machinery Co., at $37,500, for constructing steel bridge over Minnesota River for the Dan Patch Airline.

Salem, N. J.—Roadwork.—B. L. Tuft and Firman H. Lloyd, at $10,700, for constructing 1.58 miles of state road in Mannington Township.

Ashville, N. C.—Electric Railway.—Carolina Construction Co., Caldwell Bldg., Asheville, according to reports, for the construction and equipping of the Ashville & Henderson Electric Railway. The cost of the road is estimated at $500,000.

Orrville, O.—Sewage Plant.—S. W. Parshall, Akron, O., at $17,971, for constructing sewage disposal plant for this city.

Toledo, O.—Roadwork.—Thomas Sherer, for improving a mile of the Maumee Pike for the county.

Youngstown, O.—Sewer.—John Grady, at $8,850, for constructing sewer in Federal St.

Harrisburg, Pa.—Roadwork.—State Highway Department has awarded following contracts: Road in Glenburn Borough, Lackawanna County, Dale & Gaynor, Scranton, Pa.; road in Loyallhanna Township, Westmoreland County, Ridge Bros., Pittsburg, Pa.; road in Swatara Township, Dauphin County, The Maryland Co., Philadelphia, Pa.

Chattanooga, Tenn.—Sewer.—Bosler & Flynn, at $29,260, for constructing Grand View sewer. Other bids received were: Guild & Co., $30,260; Noll Construction Co., $31,262; West Construction Co., $32,232; T. J. Shea, $32,285.

Houston, Tex.—Bridges.—A. N. Fitzgerald at $9,620, for constructing three bridges; C. Derrick, at $3,549, was awarded contract for one bridge.

Center, Tex. — Railway. — John Scott & Sons, St. Louis, Mo., for the construction of 21 miles of railway to connect the A. T. & S. Fe Ry., from Center to the Texas & Gulf R. R., at Zuber. The contract calls for completion by April 1, 1908.

Tacoma, Wash.—Paving.—F. A. Keasel, at $61,400, for paving S. 19th and other streets with sandstone blocks; Barber Asphalt Paving Co., at $146,200, for paving in District 339, including N. 7th and other streets. The greater part of the paving will be asphalt with sandstone on some of the streets. Fred Essman, at $2,430, was awarded contract for laying cement sidewalks on S. 38th St.

Wenatchee, Wash.—Grading, Etc.—Jack O'Connor and the Eagle livery, at $15,000, for grading, curbing, paving, constructing sidewalks on Chelan Ave.

La Crosse, Wis.—Road.—Louis Miller, at about $7,500, for constructing main portion of new highway between Mindora and West Salem.

Fort Mackenzie, Wyo.—Water Main.—Tiersway & Garard for laying new water main at this post.

PROJECTED WORK.

Bridges.

Items Arranged Alphabetically by States.

Bessemer, Ala.—County Board of Revenue, County Court House, Birmingham, Ala., has ordered the construction of seven county bridges to be built of steel or concrete.

Riverside, Cal.—City Council has authorized Mayor Evans to arrange details for reconstruction of Victoria bridge. Work will cost about $2,000.

Rathdrum, Idaho.—Commissioners of Kootenai County have selected site for proposed bridge to be erected over the Spokane River, and bids for the work are to be asked soon, it is said. W. H. Edelbutte, Rathdrum, is County Surveyor.

Caldwell, Idaho.—City Council is to be asked to call special election to vote on issuing bonds for construction of three bridges, to cost $2,500 each.

Cedar Rapids, Ia.—Petition has been presented to City Council asking that matter of erecting new bridge at 16th Ave., be voted on at election in March.

Des Moines, Ia.—Engineers of the C. B. & Q. Ry. have been in this city in conference with George Dobson, City Engineer, regarding the construction of the proposed 7th St. viaduct to be built by the city and railway. City Engineer has also completed profile of viaduct to be built over the Des Moines River at North St.

Peoria, Ill.—Peoria & Pekin Union Ry., Stanley Millard, Chief Engineer, Peoria, has plans under way for new double track bridge to cross to gravity yards at lower end of city.

Logansport, Ind.—Construction of Marion & Logansport interurban line between this city and Marion, bids for doing which are to be asked soon, will necessitate the construction of a number of bridges, chief of which will be a $50,000 structure over the Wabash River at Logansport. Thomas E. Petrie City Engineer, Marion, Ind., is Engineer in charge of surveys for the line.

Wichita, Kan.—New plans are to be drawn for the construction of the proposed bridge across Chisholm Creek on East Douglas Ave. The bridge is to be erected by the city and by the street railway company of which Commodore S. L. Nelson, Peoria, Ill., is General Manager.

Minneapolis, Minn.—Minneapolis, St. Paul, Rochester & Dubuque Traction Co. ("Dan Patch Line") has made proposition to erect a $50,000 bridge over the Minnesota River, near Savage.

Great Falls, Mont.—County Commissioners will shortly call for bids for constructing a number of steel bridges.

Niagara Falls, N. Y.—Construction of viaducts for elimination of several grade crossings in this city will be brought before the State Grade Crossings Commission at its January meeting.

Norwalk, O.—Council has passed resolution declaring it necessary for the Wheeling & Lake Erie Railroad Co. to rebuild and raise 12 ins. the height of its overhead bridge on West Main St. L. A. Chenowith, Navarre, O., is Engineer Construction, W. & L. E. R. R.

Wilkesbarre, Pa.—Report of Committee on plans for elimination of grade crossings recommends construction of overhead bridges at Blackman, South, Conyngham, Washington and North Main Sts.

Bloomsburg, Pa.—Advices from this city state that 15 bridges owned by the Pennsylvania Lumber Co., in vicinity of Jamison City were carried away by a flood.

Butler, Pa.—County Grand Jury has reported in favor of constructing a number of small bridges.

Reading, Pa.—Applications have been made to County Commissioners for construction of four bridges.

Scranton, Pa.—Several county bridges were damaged by recent flood.

Dallas, Tex.—City will build, by day labor, a concrete bridge at Ross and Haskell Sts. Bridge will be 60 ft. wide and will have 20 ft. opening.

Dallas, Tex.—City is to construct concrete bridge at intersection of Ross and Haskell Aves.

Colfax, Wash.—County Commissioners are to at once call for bids for erecting steel bridge over Palouse River at Bridge St., Palouse. Bridge will be 100 ft. long with 20-ft. driveway and 7-ft. walk.

Spokane, Wash.—Charles McIntyre, City Engineer, in an address before the Chamber of Commerce, estimated the probable cost of bridges and viaducts, the construction of which would be demanded within the next two years, as follows: Monroe St., $320,000; N. Howard St. (S. C. channel), $70,000; Stevens St., $10,000; N. channel (Washington St.), $45,000; Olive Ave., $40,000; Mission Ave., $55,000; Sprague Ave. (trestle), $96,000; Division St. viaduct $300,000; Wash-ton St. viaduct, $264,000; Walnut St. viaduct, $18,952.

Menominee, Wis.—This city voted Dec. 17 on bonding for $30,000, for constructing bridge over Red Cedar River.

Railroads

Items Arranged Alphabetically by States.

West Point, Ga.—Chattahoochee Valley Ry. Co. has secured an amendment to its charter and proposes to extend its line from the present terminus at West Point, Ga., in a northerly direction through Troup County to a point at or near Standing Rock, in Chambers County, Alabama; thence through Chambers and Randolph Counties, in Alabama, to or near Glenn, Heard County, Ga., and to or near Texas, Heard County. L. Lanier, West Point, Ga., is President.

Atlantic, Ia.—Atlantic, Northern & Southern Ry. has practically completed all grading on the 18 miles of roadbed between this place and Kimballton, and several miles of rail have been laid. The company is also considering the extensions of the line from Atlantic to Villisca.

Wallace, Idaho.—Preliminary surveys for the Wallace-Spokane & Interstate R. R. have been completed from Wallace to Coeur d'Alene, and it is reported here that construction work will be started next spring.

Henderson, Ky.—Cross ties are reported to have been placed along the right of way of the railway which it is proposed to build between this city and Hopkinsville. The road will run to a point on the Ohio River, probably the right of way across the river purchased by the Illinois Central some time ago for the purpose of building a new bridge. The project has been promoted by Irving Wheatcroft, Providence, Ky.

Detroit, Mich.—Detroit, Toledo & Ironton Ry., according to reports, is to commence work early in the spring on the construction of 25 miles of new line reaching into the Pomeroy coal fields in Ohio. In addition it is said that the company will build extensive docks in this city. J. Wanherg, Toledo, O., is Resident Engineer.

Butte, Mont.—Bitter Root R. R. Co., organized some months ago in Oregon and having its principal office in Portland, Ore., has filed its articles of incorporation in Montana. The company proposes to build a railroad from a point near Lewiston, Idaho, to Butte, a distance of about 250 miles. The road is reported to be a Harriman project. W. W. Cotton, Portland, Ore., Secretary and General Attorney of the Oregon R. R. & Navigation Co., is interested, as is Curtis G. Sutherland and H. F. Connor, both of Portland.

Bartlesville, Okla.—Advices from this city state that construction work on the St. Louis, Bartlesville & Pacific, the new road between Joplin and some point on the Mexico City, Mexico & Orient in Oklahoma, will begin early in the spring. The right of way has been donated for almost the entire distance from Joplin to Carmen and the cash subsidies contracted for will be ample to pay for the needed right of way.

Sulphur, Okla.—Capital is reported to have been secured for the construction of the St. Louis, Springfield & Western R. R., which was chartered six months ago by A. D. Goodenough. The road as projected is to extend from Sallisaw to Lawton via McAlester and Sulphur. It will traverse both the Choctaw and the Chickasaw nations, and will give a short and direct line to the coal fields.

Wooster, O.—The Massillon, Wooster & Western Ry. Co., with headquarters in Wooster, has been incorporated. E. V. Hard, M. L. Smyserm, A. D. Metz, Albert Shupe and E. S. Landes are interested. Capital stock is $10,000.

Ontario, Ore.—Final surveys for the railway to be built by the Oregon Short Line R. R. Co., from Ontario, Ore., into Northern California, have been completed for more than 200 miles, and it is expected that construction work will be started in the spring. The line passes through some of the richest country in Oregon and California. It will pass through Madeline and Susanville, crossing the Nevada, California and Oregon Railroad at Susanville. The route in the mountain section will be through Deer Creek pass. Wm. Ashton, Salt Lake City, Utah, is Chief Engineer O. S. L. R. R.

Bristol, Tenn.—The first preliminary survey for the Bristol & Kingsport R. R., from Bristol to Kingsport through Sullivan county, East Tennessee, has been completed. The company will have another route surveyed at once. According to the survey this road can be constructed with very little expensive grading. The road will cross the Holston River railroad and will connect with the South & Western road at Kingsport.

Austin, Tex.—Texas & Gulf Ry. has filed a second amendment to its charter, providing for an extension of the line south to a connection with the Gulf, Beaumont & Great Northern, as authorized under the Santa Fe consolidation act. The amendment provided for an extension from Timpson to Center, but that is canceled, and the new amendment provides that it shall be from a station named Suber, Rapola County, to Center, on the Gulf, Beaumont & Great Northern, a distance of 21 miles. As yet no amendment has been filed providing for a northern extension from Longview to connect with the A. T. & S. Fe Ry. Contract for constructing Center-Zuber extension has been let to John Scott & Sons, Kansas City, Mo. F. G. Pettibone, Galveston, Tex., is President.

Guthrie, Okla.—Guthrie, Fairview & Western R. R., chartered in 1904, has been purchased by the Atchison, Topeka & Santa Fe Ry. The road was chartered to build from Guthrie west through Logan, Kingfisher, Blaine and Wood counties to a connection with the Kansas City, Mexico and Orient. Some of the grading has been done. Valuable franchises at Guthrie were also controlled by the company.

Stamford, Tex.—It is reported that active work will be started within 60 days on the construction of the Stamford & Northwestern R. R. Surveys are stated to have been completed to the middle of Dickens County, a distance of 150 miles.

Waco, Tex.—According to a report of Stephen Turner, Chief Engineer of the Waco, Hamilton & Brownwood R. R., a line can be secured between Waco and Brownwood, with a maximum grade of 1 per cent. The distance between the two places is 131 miles, and it is thought here that the road will be built.

Sisterville, W. Va.—Construction of a railroad between this place and Middlebourne is under consideration. E. L. Benton, Engineer, Sisterville, is reported to be

City of Mexico, Mexico.—Advices from this city state that John Cooper has asked the Mexican government for a concession to build a 1,140-kilometer line to run from the station of Comacho, in the extreme northern part of the State of Zacatecas, on the main line of the Mexican Central, to the town of Bonanzo.

Electric Railways.

Items Arranged Alphabetically by States.

Glendale, Cal.—The Los Angeles Railway Co., Los Angeles, has obtained right of way for its projected Eagle Rock electric line extension to this place, and will, it is said, soon commence construction work.

Monterey, Cal.—Surveys are being made for an electric railway to connect Carmel-by-the-Sea and this place. The money for the construction of the road has been subscribed and work will be started early next year. The Carmel Development Co., in which Frank Powers, San Francisco, is interested, proposes the road. The surveys are being made by H. B. Fisher, C. E., San Jose, Cal.

Pueblo, Colo.—Pueblo & Arkansas Valley Electric Ry. Co., mentioned in our last issue as having had surveys completed for its projected line from this city to Fowler, has been incorporated with a capital stock of $300,000. Those interested include: M. G. Saunders, Pueblo, Colo.; N. Douthitt, E. B. Chapze, M. J. Verner and Lester Wolf, all of Kansas City, Mo.

Danville, Ill.—Illinois Traction System has asked Council for a franchise for a new interurban line leaving the city on the southeast, to be known as the Danville & Southeastern Railroad Co., which is designed to connect with the line now running from Terre Haute to Clinton, Ind., owned by the McGowan syndicate.

Chicago, Ill.—The Chicago, Joliet & Central Illinois Ry. Co., with principal office in Chicago, has been incorporated. The company plans to construct a railway from Chicago southwesterly through Lyons in Cook County to Downers Creek, thence south through Lockport and to other points in the counties of Cook, DuPage, Will, Bureau, Peoria, Kendall, Grundy, LaSalle, Livingston, Marshall, McLean and Woodford. The incorporators and first board of directors are Josiah Burnham, Hugo De Loeb, George L. Turnbull, Gerald Turnbull and L. H. Strickler.

Belleville, Ill.—Red Bud & Belleville Interurban R. R. Co., has been incorporated and proposes to construct an electric railway from Belleville to Smithton, thence southeast to Red Bud. The incorporators are: Ben A. Gundlach, Belleville; Conrad Becker, Herman Schrieber and Dr. C. G. Smith, Red Bud, Ill., and John Keller of Hecker, Ill.

Red Oak, Ia.—Citizens of this place are discussing feasibility of constructing an electric railway from Red Oak to Des Moines via Greenfield. The road, if built, would be about 100 miles long. It is understood that a stock company may be formed to make preliminary surveys and interest capital. Judge Horace E. Deemer, Red Oak, is interested.

Greencastle, Ind.—City Council has granted J. M. Crabb, Indianapolis, Ind., street railway franchise here. It is proposed to make a resort of McLean Springs, and to build a line from this city to the springs.

Rochester, Ind.—The County Commissioners of St. Joseph County have granted a franchise to the Indianapolis, Logansport & South Bend Ry. Co. to construct and operate a trolley line running along the Michigan road from the southern border of the county to a point a short distance south of South Bend, where the line will enter a private right of way. According to the franchise construction must begin May 1, 1908

Bedford, Ind.—City Council has granted the Grand Central Traction Co. a 50-year franchise for the construction of an interurban railway through the city, and also to operate an electric light plant. The company has asked for a similar franchise through the city of Bloomington.

Peru, Ind.—The project for the building of an interurban line from Peru to South Bend by way of Rochester, Argos and Plymouth, which has been under consideration for two years, is now taking shape and a company has been incorporated to build the line. Among those interested are Benjamin E. Wallace, James O. Cole, Jerome Herff and Harry Masters, all of Peru.

Marion, Ind.—Final surveys are to be started Jan. 1 of the route of the Marion & Logansport interurban line. It is expected that bids for the construction of the line will be opened about March 1. It is estimated that the line can be built between Marion and Logansport for about $10,000 per mile. The work will include the construction of several bridges, of which the one over the Wabash River at Logansport will cost $50,000. Thomas E. Petrie, City Civil Engineer, Marion, is in charge of surveys for the road.

Fort Dodge, Ia.—A local press report quotes M. H. Miller, Vice President of the Fort Dodge, Emmetsburg & Spirit Lake Interurban, as stating that active construction work will be started in the early spring.

Aurora, Mo.—Henry L. Davis, City Surveyor, has been making surveys for an electric railway, which, it is stated, will ultimately connect Springfield and Joplin.

Batavia, N. Y.—Village Trustees have granted a year's extension to franchise of the Batavia, Medina & Ontario Electric Ry., chief promoter of which is Fred L. Downs, Medina, N. Y.

Tecumseh, Okla.—Rapid Transit R. R. Co. which proposes to build a line from Tecumseh to Oklahoma City, Sulphur, and then to Muskogee, has elected the following officers: President, Judge T. J. Ray; vice President, J. A. Clark; Secretary and Treasurer, J. W. Saxon.

West Chester, Pa.—West Chester & Wilmington Electric Ry. Co., with a capital stock of $54,000 and headquarters at West Chester, has been chartered and proposes to build a line from West Chester to the State line between Pennsylvania and Delaware through West Goshen, Westtown, Thornburg and Birmingham, Chester County, and Birmingham and Concord Townships, Delaware County. Thomas E. O'Connell, of West Chester, is president and a director of the company. Other directors are C. P. Faucett, Westtown Township; James A. Kirkpatrick, Birmingham; Charles Gleason, Brandywine Summit; Wills Passmore, Brandywine; F. Harvey Day, Talleyville, and M. A. O'Connell, West Chester.

Veblen, S. Dak.—A company has been organized here with a capital stock of $500,000 to construct an electric trolley line from Lidgerwood, N. Dak., to Veblen. The company has the following board of directors: T. A. and J. H. Movius of Veblen; B. F. Hammerstad, Aaron Anderson, O. P. Akre, J. B. Holsey, H. J. Hanson, P. L. Peterson and George F. Anderson. Active work will be begun on construction in the spring, it is said.

Houston, Tex.—Houston Electric Ry. Co. is perfecting plans for extending its lines to Harrisburg.

Fredericksburg, Va.—Fredericksburg & Southern Ry. Co. has applied for a charter, the terms of which authorize the company to construct and operate an electric road from some point in Hanover County to Fredericksburg and northwestwardly, and also authorizes the running of an electric railway in the city of Fredericksburg, subject to the consent of the City Council. C. W. Whitner, Rock Hill, S. C., is President; E. J. Smith, Fredericksburg, is vice President and A. T. Embrey, Fredericksburg, is Secretary and Treasurer.

Electric and Gas Plants.

Items Arranged Alphabetically by States.

Huntsville, Ala.—Expenditure of $40,000 is to be made by Huntsville Railway, Light & Power Co., in increasing capacity of its plant.

Sonora, Cal.—R. W. Hersey, San Jose, Cal., has been granted right of way in the Stanislaus National Forest for a transmission line for transmitting electric power for commercial purposes.

Ventura, Cal.—Plans for a submerged dam 1,000 ft. long to be constructed in Ventura County for the Ventura County Power Co., are being prepared by Olmstead & Gillelen. Consulting Engineers, Grant Bldg., Los Angeles, Cal.

Harrington, Del.—Local heat, light and power company has purchased the Coursey mill property and proposes to establish an electric plant there.

Moravia, Idaho.—Nels Peterson, H. Rolling and others are organizing an electric light and power company.

Flanagan, Ill.—Village Board is contemplating installing electric light plant.

Mansfield, Ill.—Local electric light plant has been purchased by William Schuler, Saybrook, Ill.

Ligonier, Ind.—City is to install lighting plant and system at a cost of $20,000.

Monticello, Ind.—Tippecanoe Electric & Power Co. has been incorporated. Capital stock is $75,000 and Abraham S. Strus is reported as interested.

Humboldt, Kans.—City is considering installing an electric light system.

City of Mexico, Mexico.—Department of Formento has granted franchise to Jose Maria Fragoso and Francisco C. Garcia for the establishment of hydraulic works on the Ameca River, in Jalisco, at the foot of Mortero hill. The water used will not exceed 10,000 ft. per second.

Kalamazoo, Mich.—Kalamazoo Power Co. recently incorporated with capital stock of $50,000 proposes to operate power and heating plant here. Frank W. Armstrong is one of the incorporators.

Linden, Mich.—The Village Council is considering the advisability of having the streets lighted by electricity to be brought from Fenton, Mich.

Pellston, Mich.—Pellston Light & Power Co. has been incorporated with a capital stock of $25,000.

Crookston, Minn.—The Crookston Water, Power & Light Co. will construct a dam at Huot, on the Red Lake River, 12 miles northeast of Crookston.

New London, N. C.—New London. Development Co., recently incorporated with capital stock of $10,000, proposes, among other things, to construct and operate electric plants. F. A. Silver, Greensboro, N. C., is interested.

Columbus, Neb.—New electric light and power plant is proposed for this place.

New Bremen, O.—A $20,000 bond issue is to be sold Dec. 30. The proceeds are to be used to purchase electric light works. A. S. Steinebrey is Village Clerk.

Ingersoll, Ont.—Rate payers will vote on bylaw authorizing expenditure of $50,000 for purchase of plant of Ingersoll Electric Power & Light Co.

McDonald, Pa.—McDonald Electric Heat & Power Co. has been organized at McDonald; capital, $100,000. A. Valentour is interested.

Pittsburg, Pa.—A. B. Shepherd, Director Public Works, is stated to be considering matter of enlarging municipal electric plant on Braddock Ave.

Gorman, Tex.—Gorman Light & Power Co. has been incorporated; capital stock is $10,000. F B. Winters and S. D. Bowles are interested.

Danville, Va.—Common Council has been considering a proposition to secure the services of a consulting electrical engineer to go into the matter of the erection of a new electric lighting plant here.

Sheppardstown, W. Va.—Sheppardstown Electric Light & Power Co. has been incorporated; capital stock is $20,000. Samuel J. Hedger is interested.

Wheeling, W. Va.—The Wheeling Electrical Co. has issued notice to council that the company will apply for an ordinance granting it a 50-year franchise.

Sewers.

Items Arranged Alphabetically by States.

Elmhurst, Cal.—Elmhurst Board of Trade is circulating petition to have County Supervisors call special election to allow the place to vote on establishing sanitary district. Issuance of $75,000 of bonds for sewers is asked.

Escondido, Cal.—Plans are practically completed for septic sewer system for this place. Olmsted & Gillelen, Grant Bldg., Los Angeles, Cal., are the engineers.

Redondo, Cal.—Board of Trustees will shortly call for bids for pumping plant and outlet pipe. Olmsted & Gillelen, Grant Bldg., Los Angeles, Cal., are the engineers.

Denver, Colo.—Board Public Works, G. E. Randolph, President, has adopted specifications for the construction of sewers in Subdistrict No. 11 of East side sanitary sewer district No. 1, and will hold a public hearing on Feb. 6. The estimated cost of the system is $104,000.

Sterling, Colo.—Sewer system is to be installed here. S. H. Sethman, Denver, Colo., is Engineer.

Washington, D. C.—District Commissioners have allotted $25,000 for service sewers in 1st St., S. W., V. St., S. W., and other streets.

Madison, Ga.—This city will sell on Dec. 31 a $50,000 bond issue for water works, sewers and electric light plant. E. W. Butler is Mayor.

Silvis, Ill.—This village, Thomas Walsh, President, proposes to install pumping station, standpipe, sewer system and septic tank. Plans prepared by H. G. Paddock, Engineer, show the cost would be about $54 000. The work will be done next summer.

Fort Wayne, Ind.—City Engineer has been instructed to modify his specifications for the Forest Park sewer, so as to include reinforced concrete pipe construction, as well as brick and vitrified clay pipe construction. Board Public Works has confirmed resolution for the sewer. W. J. Hosey is Mayor.

Coffeyville, Kan.—Plans and specifications are now before City Council for sewering District No. 3.

Louisville, Ky.—Bids were opened Dec. 17 by the Board of Sewer Commissioners, Chas. P. Weaver, Secretary, for the construction of Section B of the southern outfall sewer. Bids were received from the following companies, each of which deposited a certified check for $80,000: Kirchner Construction Co., Cincinnati; American Engineering & Construction Co. Chicago; The E. H. Abadie Co., St. Louis, Mo.; West Water & Casey, Columbus, O.; New York Continental Jewel Filtration Co., New York; Metropolitan Construction Co., Boston, Mass.; T. B. Jones & Co., St. Louis Mo.; Henry Bickel Construction Co., Louisville; Irwin Brothers, New Orleans, La.; Luck Construction Co., Roanoke, Va.; E. G. Nave & Brothers Co., Portsmouth, O.

Bar Harbor, Me.—City sewer system is to be improved and enlarged. P. H. Coombs, City Engineer, Bar Harbor, Me., is to report on the situation.

Norway, Mich.—A bond issue of $25,000 for constructing trunk sewer has been authorized.

Norway, Mich.—This place has voted a $25,000 bond issue for constructing trunk sewer.

Duluth, Minn.—As a relief for Woodland Park, City Engineer Thos. McGilvray proposes the construction of a pipe line from the present outlet to a point near the old Vermillion road, about 1,000 ft. farther down the creek, through which the sewage may be carried to a septic tank, and the affluent from that discharged into the river.

Millville, N. J.—State Sewerage Commission has threatened to bring suit against this city to compel it to construct a sewage disposal plant. City is said to have delayed the work owing to lack of funds. L. H. Miller is City Solicitor.

Seneca Falls, N. Y.—Special election is to be held Dec. 26 to vote on raising $49,500 for the completion of the partially constructed sewer system of this place. Included in the sum to be raised is $10,900 for a sewage disposal plant.

Lancaster, Pa.—City is to ask permission of State Health Department to construct a sewer.

Carlisle, Pa.—Borough Council has passed resolution to hold special election not later than June 30, 1908, to vote on issuing $150,000 of bonds for construction of sewer system and disposal plant in accordance with plans of T. Chalkley Hatton, Engineer, Wilmington, Del.

Spokane, Wash.—Charles McIntyre, City Engineer, is considering plans for the improvement of the sewer system in the business district. Separate system for carrying off rain water is favored.

Toronto, Ont.—City will at once construct 3½ miles of sewers as emergency work in order to give employment to the large number of men in the city now out of work C. H. Rust is City Engineer.

Water Supply.

Items Arranged Alphabetically by States.

La Junta, Colo.—Advices from this place state that Arkansas Valley Water Supply & Power Co., has been incorporated. Capital stock is $500,000, and Frank Finney is interested.

Waycross, Ga.—A $100,000 bond issue for extending water mains has been voted by city.

Burlington, N. C.—City has voted to issue $100,000 in bonds for the extension of its water and sewerage systems.

Wahoo, Neb.—George H. Morse, Consulting Engineer, Lincoln, Neb., is to make a test of a proposed ground water supply for this city. It is proposed to sink a 6 or 8-in. temporary well in connection with a number of smaller test wells in the vicinity, and it is intended to pump the larger well with a No. 4 centrifugal pump, with a view of getting data on the sphere of influences. The city wishes to rent such a pump to be used for two or three weeks.

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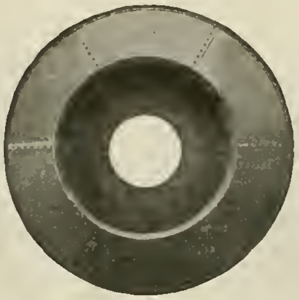

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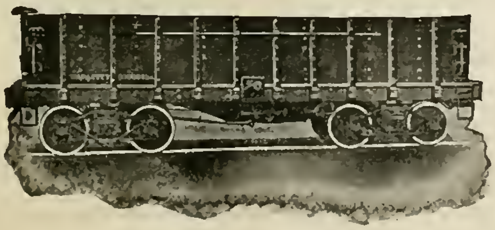

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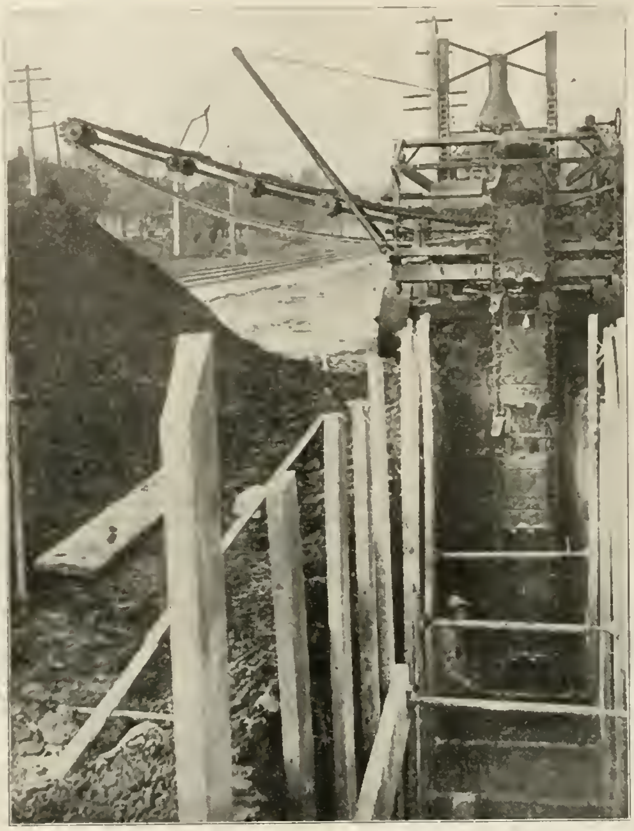

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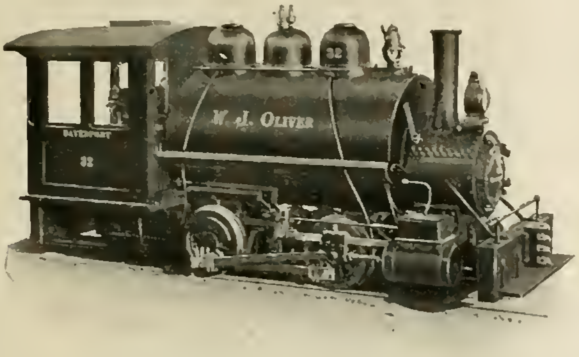

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